PUBLIC HEALTH REPORTS

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frontispiece

See poliomyelitis vaccination reports on pages 381 and 393. (Upper photograph by Esther Bubley for Wesleyan University Press; lower photograph, National Foundation for Infantile Paralysis.)

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PUBLIC HEALTH REPORTS

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
MARION B. FOLSOM, *Secretary*

PUBLIC HEALTH SERVICE
LEROY E. BURNEY, *Surgeon General*

Implications of Recent Viral Studies

By ROBERT J. HUEBNER, M.D.

SOON AFTER the bacterial causes of respiratory illnesses were delineated, it was noted that certain filterable viruses also caused such diseases. When the viruses of influenza, psittacosis, and Q fever finally became known a few years ago, it seemed that the rest of the respiratory disease problem would be solved without difficulty. Only three more agents, the viral causes of the "common cold," of acute respiratory disease (febrile catarrh), and of primary atypical pneumonia remained to be found.

However, the number of viruses that might be involved was not realized. Indeed, quite recently, River's textbook, Viral and Rickettsial Infections of Man, listed only about 60 viral agents. Today, only a few years later, with the widespread application of new techniques now available in virology, more than 65 additional, newly recognized viruses have been demonstrated in man. One would be justified, therefore, in thinking that we now know much more about the viral causes of respiratory disease. True, we do know a little more. But while isolating viruses is no longer so difficult, the eventual solution of the problem of respiratory disease is more complex.

The "new" viruses are found with great frequency in the upper part of the respiratory tract and in the enteric tract. They have been called "viruses in search of disease." Most of them are lumped under arbitrarily selected family designations such as Coxsackie, ECHO, and adenoviruses (APC–RI viruses); in addition, there are viruses such as the Sendai virus from Japan, various exanthema viruses including those reported by Neva and Rake, the virus of cytomegalic inclusion disease, and many other completely unclassified agents.

The discovery of these new agents has led to considerable progress in the etiological delineation of a number of common illnesses. It is well established that 6 to 8 of the group A Coxsackie viruses cause herpangina, a specific and very common upper respiratory disease of children with fever and other systemic involvement. Group B Coxsackie viruses have been shown to cause not only epidemic pleurodynia, but also nonbacterial meningitis, which until recently was probably most often diagnosed as nonparalytic poliomyelitis. Some of the viruses in the ECHO group, particularly type 6, have also been incriminated in the etiology of nonbacterial meningitis. The recently discovered adenoviruses cause febrile respiratory and ocular illnesses. Acute respiratory disease (ARD) of military recruits is known to be caused by at least three adenovirus serotypes. Other serotypes cause a newly described illness, pharyngoconjunctival fever (Greeley's disease), and still other types have been incriminated in the etiology of simple febrile pharyngitis and simple conjunctivitis. One type has been shown to be regularly associated with epidemic keratoconjunctivitis.

Polyvalent Vaccines

One of the more obvious opportunities provided by the easy demonstration and cultiva-

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This paper is based on a talk at the Symposium on Psittacosis, New Jersey Agricultural Experiment Station, Rutgers University, February 17, 1956, and is included in the proceedings, Progress in Research and Control of Psittacosis, Rutgers University Press, New Brunswick, N. J.

tion of so many new viruses is the preparation of effective prophylactic vaccines for the prevention of some of the very common nonfatal illnesses. Last year, our group at the National Institute of Allergy and Infectious Diseases, Public Health Service, reported a successful test of an adenovirus vaccine in which we were able to show good protection of vaccinated volunteers against experimentally induced attacks of pharyngoconjunctival fever.

At the present time Dr. Joseph Bell and I, in cooperation with U. S. Navy Medical Research Unit No. 4, are engaged in field trials of a commercially produced polyvalent vaccine containing adenoviruses types 3, 4, and 7. These studies are being carried out at the Great Lakes Naval Training Station, Great Lakes, Ill., and will eventually embrace observations on some 16,000 military recruits. Preliminary analysis of data now available show that in the vaccinated recruits there is at least a 50 percent reduction from expected rates of acute respiratory disease. These results are encouraging, not only because it may now be possible to prevent some of the more severe respiratory viral diseases, but also because they suggest that similar vaccines can be made, if it proves desirable, against representatives of the other new groups of agents, such as Coxsackie, ECHO, and exanthema viruses.

What bearing do these new developments have on the total problem of acute respiratory disease? Unfortunately, despite the notable progress in finding the etiological agents of respiratory diseases, the cause of most of them must apparently still be found, particularly the causes of those generally termed "common cold."

Of course, a good deal depends on what is meant by "common cold." To begin with, it is not the only term in popular use. "Virus X" has some obscure yet special meaning to some lay groups. Physicians in many areas use the terms "virus infection" or "virus" to characterize essentially unexplainable illnesses. It seems only a matter of time before a new virus, known as "virus X^2" will emerge.

In my opinion, the term "common cold" requires considerable analysis. Recent work with volunteers has convinced some of us that a large number of so-called common colds are not due to viruses but to other factors, not the least of which are of psychosomatic origin. The nasopharyngeal symptoms of the common cold have occurred in a high proportion of volunteers, whether or not they received virus-containing or virus-free materials. Evaluation of some of these volunteers showed in psychological tests a rather significant association of high gullibility scores with complaints of upper respiratory illness. Although more work will be necessary to put these observations on a solid basis, our findings in numerous volunteer studies indicate that susceptibility to suggestion represents a more powerful inciter of "runny" noses than any virus which we have as yet discovered.

Well-controlled evaluations of the prophylactic value of common cold vaccines and the therapeutic effects of antihistamines have shown that innocuous control materials have remarkable effects in the apparent prevention and cure of colds. More significant perhaps than the fact that these control materials seemed to perform quite as well as the presumably active materials being tested was the fact that 50 percent or more of persons receiving simple saline vaccines and sugar pills in double-blind studies regularly reported prevention, modification, or cure of colds by these innocuous substances.

Loosli's recent studies of the occurrence of common colds in industry showed that a comparatively small number of industrial workers contributed most of the absenteeism attributable to common colds. It is difficult for a virologist to conceive of viruses behaving in so illogical a manner. I might add, as the father of 8 children, 6 of whom are in school, that I cannot escape the feeling that there is very definite association of "colds" with Monday mornings. It is difficult to think of even "virus X" as causing these Monday morning episodes. Perhaps there is a "Monday morning" virus. However, I think the Victorians had a better word for it. The expression "she is indisposed" occurs time and time again in Victorian literature. It is possible, of course, that occasionally this truly represented a "viral indisposition," but I wonder whether such a virus could be grown even with modern tissue cultures or that present or future miracle drugs could cure it.

Bacterial Allergies

Of course, in addition to these rather unsubstantial ailments, there is a definite problem of specific microbial disease of nasal and pharyngeal areas, much of which is the consequence of acute infection. Here, again, it is pertinent to ask how much of recurrent respiratory illness might be due to bacterial allergies. Another hypothesis which possibly should be given more consideration is that some of the latent viruses, such as adenoviruses, persisting in the tissues of most respiratory tracts may become activated by undetermined factors and cause recurrent inflammation of the mucous membranes in those areas.

As in the case of recurrent herpes infection, such hypothetic occurrences might be expected to result in less severe illnesses than those produced by the primary infection. We have hesitated to suggest that reactivation of the adenovirus agents, demonstrably present in the nasopharyngeal passages of most persons, might represent a possible cause of common colds, since in most of those from whom such agents are recovered during afebrile illness there is generally no increase in adenovirus antibodies.

However, recurrent herpes virus infections also are not followed by any measurable antibody response. In view of the fact that adenoviruses have been isolated on several occasions from the respiratory secretions of persons with afebrile respiratory illnesses or typical common colds, the hypothesis that colds may be due to reactivation of these agents may possibly have been discarded too readily. After all, the activation of latent agents is not a rare or unknown phenomenon. The psittacosis virus in its natural host may be regarded as an agent essentially latent with the capacity of being activated at intervals. It is precisely during these exacerbations of infection and illness that birds become an important source of infection to other birds and to man.

"Unmasking" Viruses

The notable progress in the definition of acute viral diseases through application of new virological techniques is sure to be followed by more intensive application of these techniques. The development of even better ones offers promise of further progress in the study of the varied causes of acute and chronic human disease. It seems inevitable, as new and different tissues are introduced and utilized in tissue culture, that many more viral agents will be encountered. The long-term culture of normal or abnormal tissues, which is essentially a simple, if newly applied, technique for isolating viruses, may possibly turn out to be of even greater importance.

Several years ago, Dr. Wallace P. Rowe and I described viruses emerging from the epithelial cell outgrowths of human adenoids. These agents, which had a special tropism for human epithelial cells, were the first representatives of the adenovirus family of viruses to be recognized; they were found in the epithelial cells of most adenoids and tonsils, generally after 18 to 30 days of continuous culture of the original cells. They could not be demonstrated in such tissues by conventional methods of virus isolation. Serotypes 1, 2, and 5, the most commonly encountered, were subsequently shown to be acquired most often in early childhood, yet they are unmasked from the adenoids of older children and adults quite as readily as from those of infants. There is little question that following primary infection these viruses become latent or chronically infecting particles. More recently, we also succeeded in unmasking the salivary gland virus, the cause of cytomegalic inclusion disease, from the fibroblastic outgrowth of adenoids.

This agent, which was only recently first isolated in tissue culture by Dr. Margaret Smith, has long been a collector's item among pathologists who specialize in recognizing its existence in fixed tissue taken at autopsy. Subsequently, our research group and Dr. Thomas Weller at Harvard also demonstrated the agent in adenoid tissues, in biopsy of liver tissue, and from the urine of living persons, some with evidence of cytomegalic inclusion disease.

With the development of serologic techniques for studying this agent, it now appears that the salivary gland virus is a widespread infectious agent in man, approaching almost total infection in older age groups. We have also occasionally picked up herpes virus in tissue cultures of adenoid cells, and it is noteworthy that we succeeded in isolating three separate viruses,

an adenovirus, the salivary gland virus, and the herpes virus from the epithelial and fibroblastic outgrowth of the adenoid of one person.

The recent report that many different viruses have been isolated from monkey renal tissues which had been used in the production of poliomyelitis vaccine represents another interesting example of the "unmasking" of viruses from cells. The many ideas implicit in new information of this sort cannot be developed here. Perhaps the most important point is that whole areas of acute and chronic human disease, unexplained except that they are assumed to be noninfectious in origin, must be reexamined in the light of the new concepts concerning the nature and consequences of viral infections.

The simple fact that from two tissues, the human adenoid of man and the kidney of the monkey, 25 or more immunologically distinct viruses have been unmasked, supports the concept that the human cell itself must be regarded as having a considerable viral flora. Should this concept, which of course is not new to those working with bacterial and plant viruses, prove to be true, it cannot fail to have tremendous influence upon future investigations into the cause of human disease, regardless of its apparent lack of connection with microbial infection. For instance, a virologist can hardly conceive how human cells could remain uninfluenced by the viruses growing within them, and, furthermore, how such experiences could fail to be an important factor in the malfunction and erosion of cells which the clinician calls "degenerative or chronic disease."

It seems to me only a matter of time until the clinician and virologist find themselves collaborating not only in an effort to cure sick cells but also in attempting to prevent such occurrence.

Board of Regents of the National Library of Medicine

Dr. Worth B. Daniels, clinical professor of medicine at Georgetown University, was elected chairman of the Board of Regents of the National Library of Medicine. At its first meeting, March 20, 1957, the 17-member board also elected as vice chairman Dr. Champ Lyons, professor of surgery, University of Alabama Medical College, and as secretary of the board, Lt. Colonel Frank B. Rogers, library director. The board is authorized by the 84th Congress to advise the Surgeon General of the Public Health Service on the policy of the library.

Ten board members are appointed by the President from the fields of science, medicine, and public affairs, and seven are ex officio members in Government service. The chairman is elected from among the appointed members.

Other appointed members of the board are: Dr. Basil G. Bibby, professor of dentistry, University of Rochester; Dr. Jean A. Curran, Bingham Associates Fund, Boston; Dr. Michael E. Debakey, professor of surgery, Baylor University; Dr. Thomas Francis, Jr., professor of epidemiology, University of Michigan; Miss Mary Louise Marshall, professor of medical bibliography, Tulane University; Dr. I. S. Ravdin, professor of surgery, University of Pennsylvania; Dr. Benjamin Spector, professor of anatomy, Tufts University; Dr. Ernest Volwiler, president, Abbott Laboratories.

Ex officio members are: Dr. Leroy E. Burney, Surgeon General, Public Health Service; Major General S. B. Hays, Surgeon General, U. S. Army; Rear Admiral B. W. Hogan, Surgeon General, U. S. Navy; Major General D. C. Ogle, Surgeon General, U. S. Air Force; Dr. William S. Middleton, chief medical director, Veterans Administration; Dr. John T. Wilson, assistant director for biological and medical sciences, National Science Foundation; and Dr. L. Quincy Mumford, Librarian of Congress.

Surveillance of Poliomyelitis in the United States in 1956

COLLECTION and dissemination of epidemiological data on the safety and effectiveness of poliomyelitis vaccine are the primary functions of the National Poliomyelitis Surveillance Program, which was established in April 1955 at the Communicable Disease Center of the Public Health Service. These data are summarized and distributed currently in the mimeographed Poliomyelitis Surveillance Reports, which are available to all persons with responsibility in the control of poliomyelitis. A review of information collected in 1955 has been published (*1*). The present report summarizes the data for 1956.

As part of the surveillance program a clearinghouse of information is maintained in the Poliomyelitis Surveillance Unit, Communicable Disease Center. There is constant mutual exchange of data between the unit and State and local health departments, virus diagnostic laboratories, the National Foundation for Infantile Paralysis, and others. More than 40 officers of the Communicable Disease Center's Epidemic Intelligence Service contribute to this activity.

This report was prepared by the staff of the Poliomyelitis Surveillance Unit: Dr. Neal Nathanson, chief; Dr. William Jackson Hall, assistant chief; Dr. Lauri D. Thrupp, epidemic intelligence service officer; and Helen Forester, statistician. The unit is part of the Epidemiology Branch (of which Dr. Alexander D. Langmuir is chief), Communicable Disease Center, Public Health Service, Atlanta, Ga. *The paper was presented at a meeting of representatives of State medical societies, called by the American Medical Association, in Chicago, January 26, 1957.*

Poliomyelitis Incidence in 1956

During 1956 a total of 15,400 cases of poliomyelitis were reported to the National Office of Vital Statistics, Public Health Service, a rate for the United States of 9.2 cases per 100,000 population. This is the lowest rate reported since 1947. Marked annual variations in poliomyelitis incidence are apparent from a comparison of rates for the years 1910 through 1956 (fig. 1) and from a comparison of poliomyelitis incidence by weeks for 1956 with the years 1946 through 1955 (fig. 2). Because of these wide annual variations in incidence, it is not yet possible to attribute the low incidence reported in 1956 to the widespread, although incomplete, use of poliomyelitis vaccine. Further decreases in incidence over the next several years may be of greater significance.

The 1956 incidence rates for six geographic regions, with median rates for the period 1951–55, appear in table 1. The highest regional rates in 1956 were in the Southwest, the South Central, and the North Central States; these same regions also had the highest 5-year median rates. Lowest 1956 rates and lowest 5-year median rates were reported for the Northeast and the Southeast.

For individual States a similar comparison of 1956 rates with 5-year median rates appears in figure 3. (The number of cases reported in 1956 for each State, by paralytic status, is given in table 2.) The four States with the highest 1956 rates were Utah, Iowa, Louisiana, and Illinois, in that order. None of these States experienced particularly low median rates for the previous 5 years. The high 1956 incidence in Utah reflects an epidemic in Salt Lake City and the surrounding area. The cases reported

from Iowa undoubtedly include many cases of nonpoliomyelitis viral meningitis since less than 10 percent of the cases were reported as paralytic and since isolations of Coxsackie virus were reported from outbreaks in four areas of the State. Only in Louisiana did reported incidence exceed the 5-year median; high endemic rates were reported in several areas of this State. The largest concentrated outbreak during 1956 occurred in Chicago. More than 1,100 cases were reported, a rate of about 30 per 100,000.

Vaccine Safety

Surveillance of vaccine safety is based primarily on analysis of poliomyelitis cases occurring within 30 days of a poliomyelitis vaccination. Cases of this kind are routinely reported to the Poliomyelitis Surveillance Unit by all State and Territorial health departments. In addition, this phase of the program includes collection of some data on possible reactions to the vaccine.

Poliomyelitis Following Vaccination

With more than 70 million inoculations of vaccine given during 1956 and with considerable amounts of vaccine used in high-incidence areas, it is clear that by coincidence alone a large number of cases would be expected to occur shortly after vaccination. Thus, the purpose of surveillance of vaccine safety is to determine whether coincidence is an adequate explanation for all the cases occurring shortly after vaccination. It must be recognized, now that vaccine is frequently used during periods of high incidence, that epidemiological methods may not detect the occurrence of small numbers of vaccine-related poliomyelitis cases.

Cases are currently analyzed for (*a*) excessive frequency of association with individual lots of vaccine, (*b*) concentration within the 4- to 11-day period of the intervals between inoculation and onset, and (*c*) correlation between sites of inoculation and sites of first paralysis. These were the distinguishing epidemiological characteristics of the cases in 1955 associated with vaccine manufactured by Cutter Laboratories (*1*).

During 1956, 500 under-30-day cases were reported, 229 of which were paralytic. (This total does not include a group of more than 300 cases in Chicago, which will be discussed in a later section of this paper.) Comparison of these 229 paralytic cases with the 70 million doses of vaccine administered gives an average ratio of about 1 paralytic case for every 300,000 inoculations. Classification of cases according to manufacturers and lot numbers of the vaccine used showed that only 5 lots distributed in 1956 were associated with more than 5 paralytic cases, while half (67) of the lots were not associated with any paralytic cases. Analysis of the 5 lots associated with more than 5 paralytic

Figure 1. Annual poliomyelitis incidence rates in the United States, 1910–56.

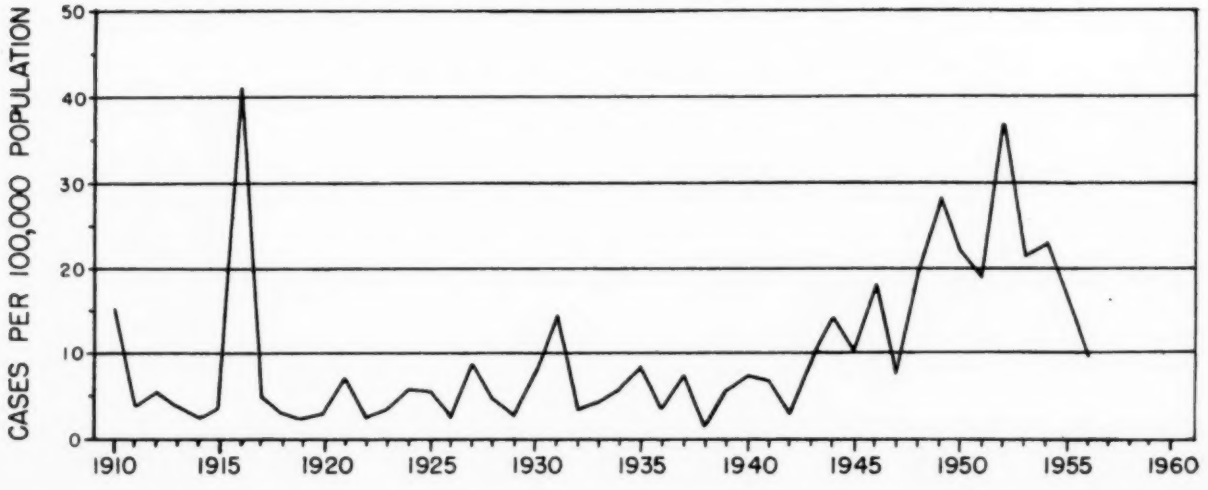
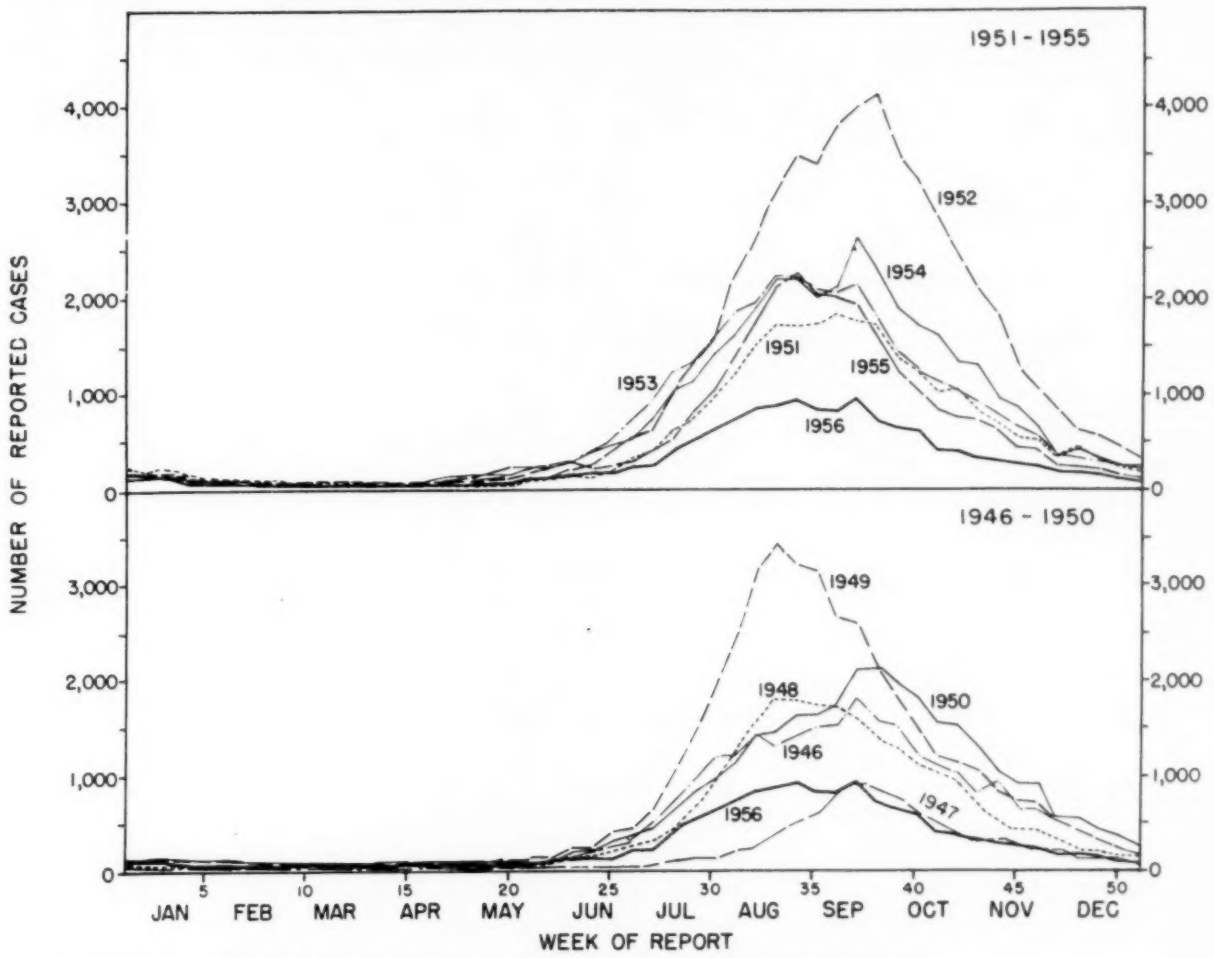


Figure 2. Poliomyelitis incidence in 1956 compared with the years 1946 through 1955.



NOTE: Data provided by National Office of Vital Statistics, Public Health Service.

cases showed that in all instances these lots had been used during the summer and in areas experiencing high or epidemic incidence of the disease and that these cases did not exhibit the other epidemiological characteristics of the Cutter cases.

When intervals between inoculation and onset were examined for the 229 paralytic vaccinated cases, it was found that 53 percent of the cases occurring 0–15 days after inoculation fell in the 4- to 11-day period, very close to the 50 percent expected by chance. The corresponding percentage for the Cutter cases was 88.

Analysis of the relationship between sites of inoculation and first paralysis showed the following: Of the 229 paralytic cases, 164 had spinal involvement, and of these 164, the site of inoculation was known for 150. Among these 150, initial involvement included either the inoculated or the opposite uninoculated extremity, or both, in 31. Of these 31, only the inoculated limb was involved in 21, only the opposite uninoculated limb was involved in 6, and both limbs were involved in 4. This slight excess of correlated cases (21) over uncorrelated cases (6) may indicate the occurrence of a small number of vaccine-related cases. However, the correlated cases were spread among 19 lots of vaccine. Also, analysis of a comparison group of 905 cases that occurred more than 30 days after vaccination showed a similar excess of correlated over uncorrelated cases (13 and 6, respectively). Although the frequency of correlation in the small group of under-30-day cases suggests vaccine-related poliomyelitis, the

similar frequency of correlation for the over-30-day cases precludes any definite conclusion. However, if it is assumed that the excess of 15 correlated under-30-day cases was due to prior inoculation, then the vaccine has influenced the development of considerably less than one paralytic case per million inoculations.

Vaccine Reactions

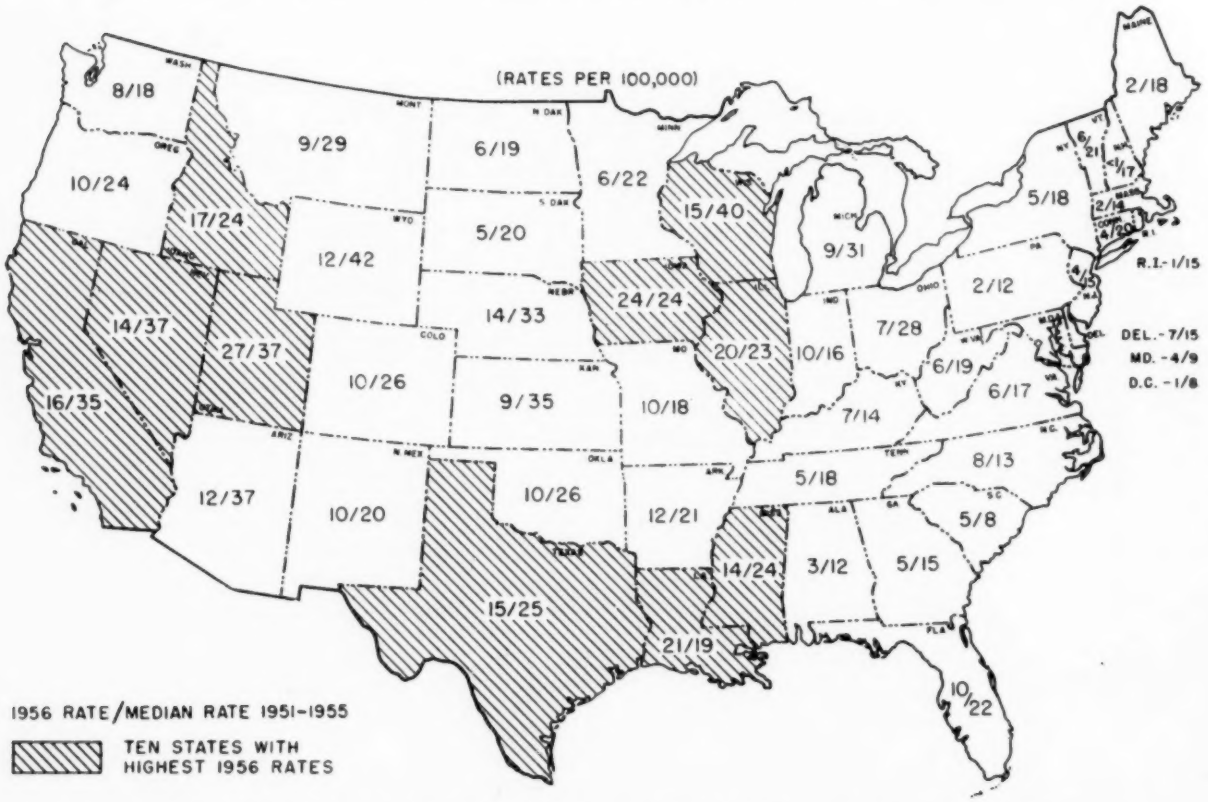
Vaccine reactions that have been considered possible hazards include encephalitis or other neurological illnesses such as may occur following use of smallpox or other vaccines; allergic reactions to the traces of penicillin and foreign proteins in the vaccine; nephritis or other renal diseases attributable to reaction to residual monkey kidney proteins in the vaccine; and sensitization of Rh negative persons by Rh positive antigen potentially present in the vaccine. To evaluate these hazards, the Poliomyelitis Surveillance Unit has collected reports of a number of nonpoliomyelitis illnesses occurring shortly after vaccination. Although the reports are undoubtedly incomplete and no final evaluation can be reached at present, the following observations can be made:

Table 1. Reported poliomyelitis incidence rates for 1956 and median rates for 1951–55, by geographic region

Region [1]	Rate for 1956 [2]	Median rate for 1951–55 [2]
United States	9.2	23
Northeast	3.5	17
North Central	11.9	27
Northwest	9.7	24
Southeast	5.9	18
South Central	15.1	27
Southwest	15.6	36

[1] See table 2 for States included in each region.
[2] Per 100,000 population.

Figure 3. Poliomyelitis incidence rates in 1956 compared with median rates in 1951–55.



NOTE: Based on data provided by the National Office of Vital Statistics, Public Health Service, and the Bureau of the Census.

Table 2. Number of poliomyelitis cases reported in the United States and Territories, by State and paralytic status, 1956 [1]

Region and State	Paralytic	Nonparalytic	Total [2]	Region and State	Paralytic	Nonparalytic	Total [2]
Northeast	**463**	**573**	**1,471**	**Southeast**	**940**	**795**	**1,971**
Maine	16	4	22	Delaware	10	18	28
New Hampshire	[3]	1	3	Maryland	89	22	111
Vermont	12	9	21	Dist. of Columbia	7	4	11
Massachusetts	44	50	111	Virginia	150	84	236
Rhode Island	1	[3]	9	West Virginia	60	47	114
Connecticut	28	55	86	North Carolina	178	144	336
New York	289	357	797	South Carolina	38	56	114
New Jersey	73	97	212	Georgia	77	66	197
Pennsylvania	[3]	[3]	210	Florida	103	170	365
				Kentucky	75	88	200
North Central	**2,123**	**2,403**	**5,856**	Tennessee	91	55	156
Ohio	165	146	628	Alabama	62	41	103
Indiana	179	125	433				
Illinois	964	630	1,843	**South Central**	**1,516**	**928**	**2,723**
Michigan	283	323	683	Mississippi	154	66	296
Wisconsin	199	189	554	Arkansas	144	77	221
Minnesota	66	139	205	Louisiana	427	195	622
Iowa	44	526	629	Oklahoma	67	30	224
Missouri	117	133	421	Texas	724	560	1,360
North Dakota	7	27	40				
South Dakota	3	13	38	**Southwest**	**1,484**	**1,035**	**2,814**
Nebraska	42	110	195	Colorado	86	67	162
Kansas	54	42	187	New Mexico	36	21	84
				Arizona	73	54	130
Northwest	**242**	**184**	**565**	Utah	[3]	[3]	224
Montana	32	15	55	Nevada	1	2	35
Wyoming	20	12	37	California	1,288	891	2,179
Idaho	43	21	110				
Washington	71	60	190	Total	6,768	5,918	15,400
Oregon	76	76	173				
				Alaska	7	2	12
				Hawaii	51	17	68
				Puerto Rico	45	6	51

[1] Provisional data reported to the National Office of Vital Statistics, Public Health Service.

[2] Includes cases reported with paralytic status unspecified (2,714 for the United States).

[3] None of the cases reported so designated.

- Vaccine reactions are rare.
- Neurological illnesses following vaccination include 2 cases of encephalitis, 5 cases of myelitis, 1 sudden death (no definite cause found on autopsy), and a small number of minor self-limited illnesses such as meningismus, febrile convulsions, and labyrinthitis. It appears unlikely that these illnesses are related to prior vaccination, but further information must be collected, particularly on cases of encephalitis and myelitis, before any final evaluation can be reached.
- Local or generalized mild allergic reactions (such as urticaria) may occur in rare instances following vaccination. Two reports have been received of more severe dermatological illnesses following vaccination, but their relationship to prior inoculation appears questionable.

Table 3. Percentage distribution of paralytic and nonparalytic poliomyelitis cases, by age group, 1952, 1955, 1956 [1]

Age group (years)	Percent distribution					
	Paralytic			Nonparalytic		
	1952	1955	1956	1952	1955	1956
0–4	29	32	39	21	19	20
5–9	24	21	16	31	29	27
10–14	13	12	11	16	17	16
15 and over	33	34	34	31	34	37
Total	100	100	100	100	100	100

[1] Based on provisional data, including 21,971 cases from 22 States in 1952, 18,378 cases from 34 States in 1955, and 10,286 cases from 45 States in 1956. Cases in which paralytic status was not stated are excluded.

• There have been no reports of nephritis or other renal disease following vaccination.

• There have been no reports of hematological illnesses in which vaccine was considered to play a role.

Vaccine Effectiveness

Evaluation of vaccine effectiveness includes an analysis of the age distribution of cases by vaccination and paralytic status, a special study of the frequency of paralysis in hospitalized patients according to number of vaccine doses, special studies in three States comparing attack rates among vaccinated and unvaccinated children, and an analysis of reports of cases among persons who had received three doses of vaccine.

Age Distribution Analysis

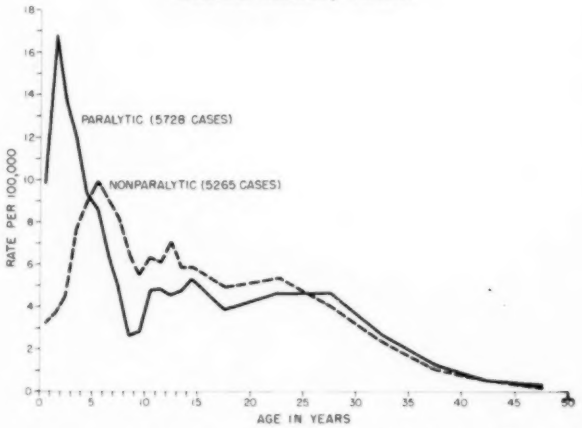
During 1956, 44 States, the District of Columbia, and 3 Territories cooperated with the Poliomyelitis Surveillance Unit in an age distribution study. They reported to the unit the age, paralytic status, and vaccination history of all verified cases of poliomyelitis. These cases represent about three-fourths of all cases reported for the Nation. Data by age and paralytic status for 1955 and 1952, collected from a number of States in a similar study conducted in 1955, were available for comparison. Three separate qualitative measures of vaccine effectiveness are apparent from a preliminary analysis of the 1956 data in relation to the earlier data.

A definite shift was observed in the age distribution of paralytic cases. In comparison with data for 1955 and 1952, 1956 data showed an increase in relative incidence in the under-5-year age group, with a compensatory decrease in the relative incidence in the 5-to-9-year age group (table 3). No significant change was apparent in the age distribution of nonparalytic cases. This shift in age distribution of paralytic cases may be associated with the known fact that the young school age group was more extensively vaccinated than the preschool age group. In particular, children in the first and second grades of school in the spring of 1955, who were largely 8- and-9-year-olds during the past poliomyelitis season, were thoroughly vaccinated in school clinics sponsored by the National Foundation for Infantile Paralysis. The reduction in paralytic incidence in this group is apparent in figure 4, which shows age-specific attack rates by single years of age. The paralytic age curve peaks sharply at age 1 and decreases rapidly through age 6. Except for the trough at ages 8 and 9, the age-specific rates remain relatively constant from ages 7 to 30, decreasing gradually thereafter.

Although the overall frequency of paralysis by age groups was similar to that reported in 1955 (table 4), the frequency of paralysis among reported cases in the under-20-year age group was markedly lower among vaccinated cases, 34 percent, than among unvaccinated cases, 60 percent (table 5). This difference supports the conclusion that vaccination prevented some paralysis.

Among the paralytic cases reported during the midsummer season in the under-20-year age group, 21 percent were vaccinated (table 6). This figure may be compared with estimates of the proportion of the population under 20 that had received one or more doses by that time. A conservative figure is 50 percent. The difference points to a vaccine effectiveness of the order of 75 percent against paralytic poliomyelitis. (Seventy-nine percent of the paralytic cases occurring in the unvaccinated population and 21 percent occurring in the same number of vaccinated persons indicate a reduction in the vaccinated rate compared with the unvac-

Figure 4. Age distribution of poliomyelitis in the United States, 1956.



NOTE: Preliminary and incomplete data from 45 States.

Table 4. Frequency of paralysis in poliomyelitis cases, by age group, 1952, 1955, and 1956 [1]

Age group (years)	Percent paralytic		
	1952	1955	1956
0–4	69	65	69
5–9	56	44	40
10–14	57	44	43
15 and over	64	53	50
All ages	62	52	52

[1] Based on provisional data, including 21,971 cases from 22 States in 1952, 18,378 cases from 34 States in 1955, and 10,286 cases from 45 States in 1956. Cases in which paralytic status was not specified are excluded.

cinated rate proportional to the reduction from 79 to 21. This reduction is $(79-21)\div 79=73$ percent.) A similar computation may be made for the 5-to-9-year age group. It is estimated that at least two-thirds of this age group had been vaccinated, while one-third of the paralytic cases in the age group were vaccinated (fig. 5 and table 6). This difference again leads to a crude estimate of 75 percent effectiveness against paralytic poliomyelitis. (Two-thirds of the paralytic cases occurring in the unvaccinated population and one-third in twice as many vaccinated persons indicate a reduction in the vaccinated rate compared with the unvaccinated rate proportional to the reduction from $\frac{2}{3}$ to $\frac{1}{3}\div 2$. This reduction is $(\frac{4}{6}-\frac{1}{6})\div\frac{4}{6}=75$ percent.)

NFIP Study

The National Foundation for Infantile Paralysis conducted a study of hospitalized poliomyelitis patients during the height of the 1956 poliomyelitis season. Reports were received on 3,198 patients with acute cases in 408 hospitals in 48 States. When these patients were grouped according to number of vaccine doses received prior to onset, the frequency of paralysis declined progressively from 59 percent among unvaccinated patients to 23 percent among those who had received three doses (fig. 6). Thus, this study provides additional evidence of the effectiveness of the vaccine in 1956.

Special Studies in Three States

During the past year California, Florida, and Minnesota were able to follow the distribution of vaccine in sufficient detail to obtain reasonable estimates of vaccinated populations by age groups. Current State estimates of the total population in the age groups studied were used. After estimation of the size of the vaccinated group, the size of the unvaccinated group was obtained by subtraction. Attempts at direct measurement of vaccine effectiveness during 1956 in preventing paralytic poliomyelitis were thus possible in these States.

Several factors introduce sources of potential bias in these analyses. Case reports were received through morbidity reporting systems of widely varying accuracy. Total population

Table 5. Frequency of paralysis in poliomyelitis cases, by age and vaccination history, 1956 [1]

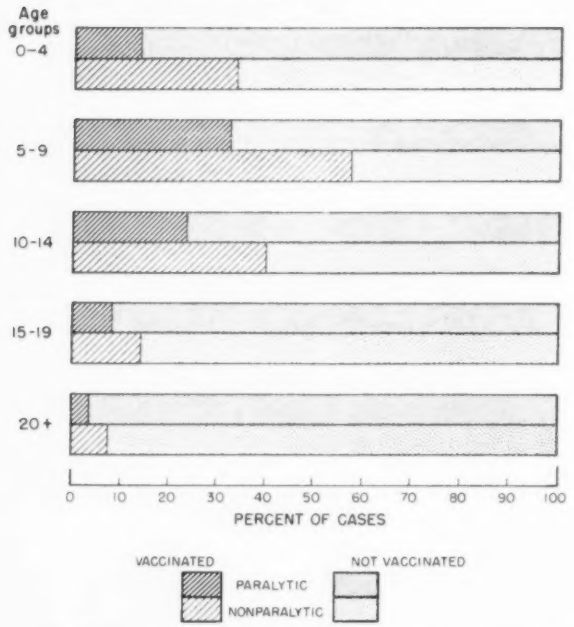
Age group (years)	Vaccinated [2]		Not vaccinated		Total	
	Total cases	Percent paralytic	Total cases	Percent paralytic	Total cases	Percent paralytic
0–4	610	46. 7	2, 471	73. 9	3, 081	68. 5
5–9	1, 026	27. 2	1, 144	50. 9	2, 170	39. 7
10–14	461	30. 8	939	49. 1	1, 400	43. 1
15–19	103	31. 1	783	45. 8	886	44. 1
0–19	2, 200	33. 5	5, 337	60. 5	7, 537	52. 6
20 and over	152	33. 6	2, 597	53. 0	2, 749	51. 9
Total	2, 352	33. 5	7, 934	58. 0	10, 286	52. 4

[1] Based on preliminary and incomplete data from 45 States. A total of 1,107 cases, representing 10 percent of the total reported cases in these States, are excluded because one or more of the following were reported as unknown: paralytic status, vaccination history, month of onset, or age.

[2] Cases with one or more inoculations prior to onset are classified as vaccinated.

figures and vaccine usage figures (particularly for commercial supplies of vaccine) were necessarily estimates. Variations in geographic and age-specific vaccination rates and attack rates could not be completely accounted for. Risk of exposure was assumed to be equal in the two populations and constant throughout the study period. Although attempts have been made to minimize the effect of these sources of error, interpretations of the results must necessarily be guarded.

Figure 5. Percentage of paralytic and nonparalytic poliomyelitis cases reported as vaccinated and as not vaccinated, 1956.



NOTE: Preliminary and incomplete data from 45 States.

Estimates of effectiveness according to numbers of doses are not reported here. Thus, the estimates represent overall effectiveness of varying composites of 1, 2, and 3 doses of vaccine and should be interpreted accordingly.

Preliminary results of these studies are summarized in table 7. In each State, paralytic attack rates were significantly lower among vaccinated persons than among unvaccinated persons. Each of these independent studies indicates an overall vaccine effectiveness in preventing paralytic poliomyelitis of about 75 percent. These results are in general agreement with results of similar analyses conducted in 1955 (*1*).

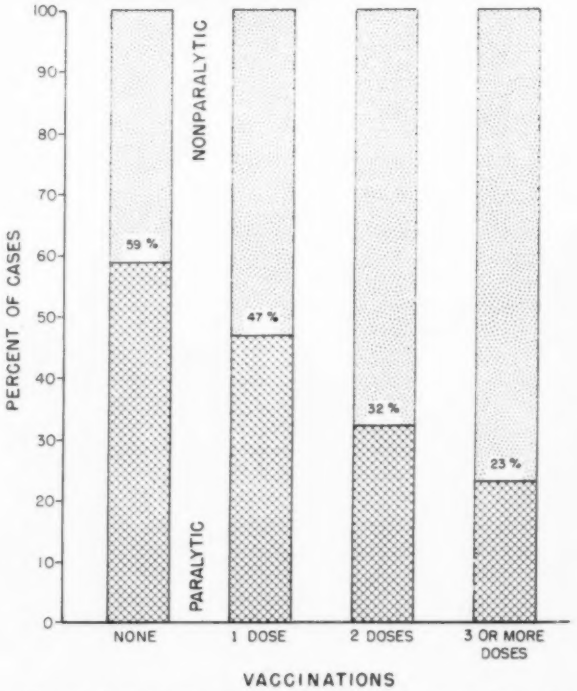
Triple-Vaccinated Cases

In September 1956 a national registry was established in the Poliomyelitis Surveillance Unit for reports of poliomyelitis among individuals who have received three doses of vaccine. Recorded data include clinical, epidemiological, and laboratory information. Residual paralysis is being documented by convalescent muscle gradings or supplemental descriptions from attending physicians. In a few cases followup information has resulted in a revised diagnosis or changed paralytic or vaccination status. Triple-vaccinated cases reported through January 18, 1957, have received the following classifications:

	Number of cases
Nonparalytic	154
Paralytic	34
Confirmed, with residual paralysis	19
Under investigation	9
Revoked (not paralytic or not vaccinated)	6
Total cases	188

More stringent criteria have been applied in establishing these triple-vaccinated cases as par-

Figure 6. Frequency of paralysis in hospitalized cases of poliomyelitis, by vaccination history, Aug. 15–Sept. 30, 1956.



NOTE: Data from a survey by the National Foundation for Infantile Paralysis.

Table 6. Percentage of poliomyelitis cases reported as vaccinated, by paralytic status, age group, and month of onset, 1956 [1]

Age group (years)	January–June		July–November		Total	
	Total cases	Percent vaccinated [2]	Total cases	Percent vaccinated [2]	Total cases	Percent vaccinated [2]
	Paralytic cases					
0–4	694	8. 4	1, 417	16. 0	2, 111	13. 5
5–9	257	29. 6	604	33. 6	861	32. 4
10–14	172	15. 1	431	26. 9	603	23. 5
15–19	91	2. 2	300	10. 0	391	8. 2
0–19	1, 214	13. 3	2, 752	20. 9	3, 966	18. 7
20 and over	353	1. 4	1, 074	4. 3	1, 427	3. 6
All ages	1, 567	10. 7	3, 826	16. 3	5, 393	14. 6
	Nonparalytic cases					
0–4	178	24. 7	792	35. 5	970	33. 5
5–9	246	50. 0	1, 063	58. 7	1, 309	57. 1
10–14	139	28. 8	658	42. 4	797	40. 0
15–19	84	7. 1	411	15. 8	495	14. 3
0–19	647	32. 9	2, 924	42. 7	3, 571	40. 9
20 and over	252	1. 6	1, 070	9. 1	1, 322	7. 6
All ages	899	24. 1	3, 994	33. 7	4, 893	31. 9

[1] Based on preliminary and incomplete data from 45 States. A total of 1,107 cases, representing 10 percent of the total reported cases in these States, are excluded because one or more of the following were reported as unknown: paralytic status, vaccination history, month of onset, or age.

[2] Cases with one or more inoculations prior to onset are classified as vaccinated.

alytic poliomyelitis than are used in the routine reporting of the disease. For this reason it is not possible to compare directly these triple-vaccinated cases with other groups of paralytic cases, vaccinated or unvaccinated.

Laboratory specimens have been collected on 16 of the 19 confirmed paralytic cases. Poliovirus was isolated from 7, other virus from 2, and no virus from 3. Final laboratory results have not yet been submitted on the four remaining cases. Thus, to date, seven triple-vaccinated paralytic cases have received laboratory confirmation.

Three deaths from poliomyelitis have been reported in triple-vaccinated persons. One case was established as bulbar poliomyelitis, but a recheck of vaccination records revealed that the child had never been vaccinated. A second case was clinically consistent with poliomyelitis, but pathological review revealed instead the anatomic findings of acute disseminated encephalomyelitis. The one remaining fatal case occurred in a 5-year-old boy who died the day after onset of fever and within 30 minutes of hospitalization. Findings of an autopsy performed without examination of the brain or spinal cord were reported as compatible with poliomyelitis. This is the only fatal case now being carried in the registry.

Vaccine Under Epidemic Conditions

There has been particular interest in evaluation of the effectiveness and possible dangers of administering poliomyelitis vaccine during epidemics. In particular, based on previous studies with diphtheria and pertussis antigens, it had been feared that the vaccine might "provoke" the development of subsequent paralysis in persons infected at the time of, or shortly after, vaccination. The first study of this problem was conducted during a small outbreak of poliomyelitis among U. S. Navy personnel and

dependents in Hawaii in late 1955 (*2*). This analysis revealed no evidence of a "provoking" effect.

In 1956 the largest concentration of poliomyelitis occurred in Chicago, where more than 1,100 cases were reported. This outbreak presented an unusual opportunity for the study of mass vaccination under epidemic conditions. In collaboration with the Chicago Board of Health, the Cook County Health Department, the Illinois Department of Public Health, the division of services for crippled children of the University of Illinois, and the National Foundation for Infantile Paralysis, the Public Health Service undertook an epidemiological, clinical, and laboratory study of poliomyelitis cases occurring in Chicago and suburban Cook County.

Table 7. Results of three studies of vaccine effectiveness, 1956

Item	California,[1] June 1–Aug. 31 (ages 0–14 years)	Florida,[2] June 1–Aug. 31 (ages 0–19 years)	Minnesota,[3] Aug. 1–Oct. 31 (ages 0–19 years)
Estimated person-months at risk (hundred thousands):			
Vaccinated	96. 66	4. 35	20. 86
Not vaccinated	99. 66	8. 19	13. 06
Paralytic cases:			
Vaccinated	111	5	8
Not vaccinated	398	38	24
Paralytic rates (per 100,000 population):			
Vaccinated	1. 2	1. 1	. 4
Not vaccinated	4. 0	4. 6	1. 8
Estimated effectiveness (percent)[4]	71	75	79
Lower limit of effectiveness (percent)[5]	66	44	57

[1] Data reported by Drs. A. C. Hollister, Jr., and R. L. Magoffin, bureau of acute communicable diseases, California Department of Public Health, and by Drs. G. L. Caplan and M. L. Wyman, epidemic intelligence service officers, assigned to the California Department of Public Health.

[2] Data reported by Drs. J. O. Bond and W. T. Sowder, Florida State Board of Health.

[3] Data reported by Drs. H. Kleinman and C. S. Fleming, division of disease control and prevention, Minnesota Department of Health.

[4] Difference between unvaccinated and vaccinated rates, divided by unvaccinated rate. Vaccine effectiveness thus expresses the percent reduction in the vaccinated attack rate as compared with the unvaccinated rate. Presumably, this reduction is due largely to the vaccine.

[5] Calculated at the 95 percent confidence level according to the method used by Francis and associates (reference 3, appendix, p. 62).

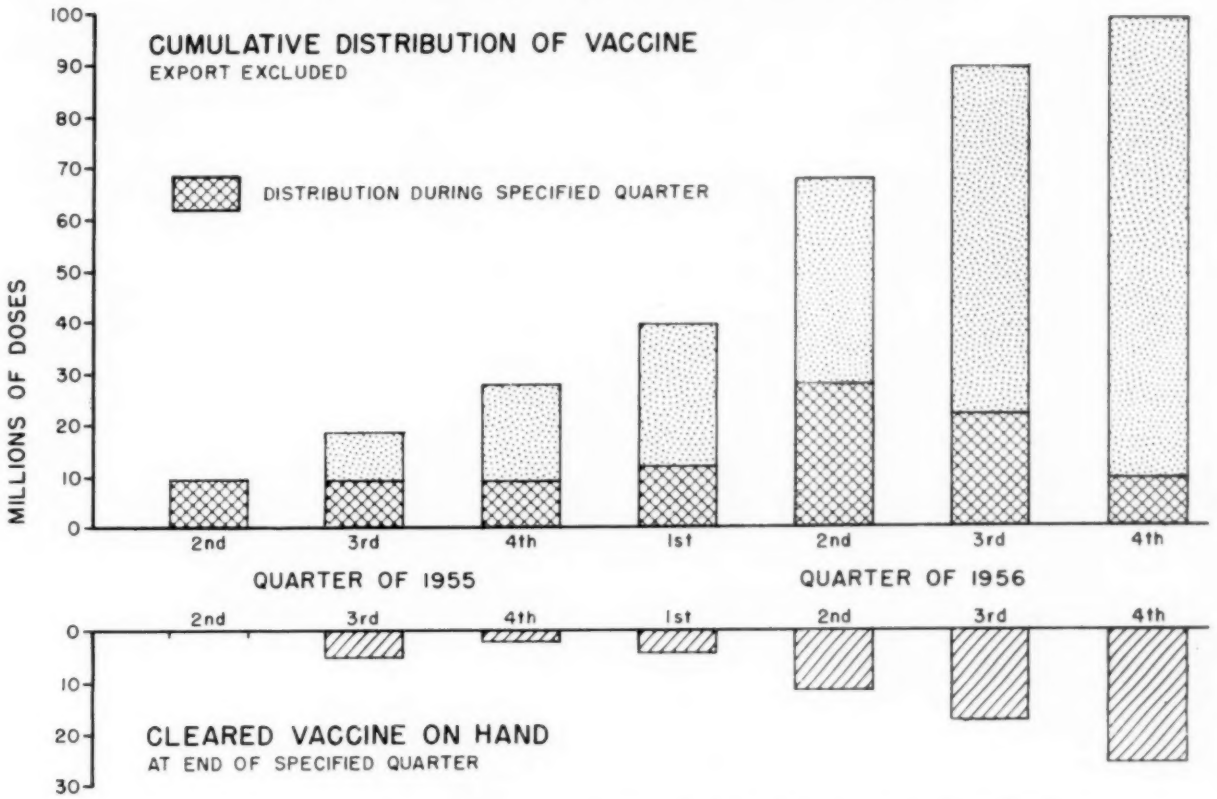
Preliminary analysis of epidemiological data showed patterns differing markedly from previous years, particularly the last previous epidemic year of 1952. In 1952 cases were scattered quite evenly throughout the city. In 1956 early cases were also scattered widely, indicating a general dissemination of the virus. However, as the outbreak progressed, high rates developed only in those areas of the city characterized by a particularly dense population, a low socioeconomic status, and a high proportion of nonwhites. In 1952 cases among nonwhites constituted 14 percent of the total cases as compared with 61 percent in 1956. In 1956 there was a shift in the age distribution of cases toward the preschool age group. This shift was particularly marked for the cases in the white population.

Preliminary analysis of clinical and laboratory data has revealed no unusual findings. About 60 percent of the cases were reported as paralytic. Stool specimens obtained from a large number of cases and examined by the laboratories of the Illinois Department of Public Health yielded predominantly type 1 poliovirus.

In late July 1956, during a period of rapidly rising incidence, the Chicago Board of Health initiated a large-scale mass vaccination program. Through the cooperative efforts of medical and other organizations in the city, more than 1.5 million doses were administered in less than 2 months. However, this program began too late to demonstrate any dramatic effect upon the epidemic curve.

In an attempt to delineate any possible "provoking" effect following this large number of inoculations, a preliminary analysis of about 400 vaccinated cases (including more than 300 cases occurring within 30 days of inoculation) was made. This analysis revealed no evidence that prior inoculation influenced the localization of subsequent paralysis. Among paralytic cases, there were 11 with initial involvement of the inoculated limb, 11 with initial involvement of the opposite uninoculated limb, and 13 with involvement of both the inoculated limb and the opposite uninoculated limb.

Figure 7. Distribution of poliomyelitis vaccine, 1955–56.



NOTE: Data from Poliomyelitis Vaccine Activity, Bureau of State Services, Public Health Service.

A more complete presentation of findings in Chicago during 1956 will be published under the direction of Dr. Herman N. Bundesen, president, Chicago Board of Health.

Vaccine Distribution

During 1955 and 1956 a total of 98.2 million doses of poliomyelitis vaccine were distributed for domestic use, including 27.7 million doses from April through December 1955 and 70.5 million doses in 1956. An additional 6.5 million doses were exported during recent months of 1956. Through the end of 1956, a cumulative total of 130.6 million doses of vaccine (net cubic centimeters of bottled vaccine) had been released after clearance by the National Institutes of Health, Public Health Service, leaving a balance of 25.9 million doses on hand at the close of the year.

Distribution of vaccine by calendar quarters is presented in figure 7. Quarterly shipments of vaccine reached a peak in the second quarter of 1956, when 27.8 million doses were distributed. Shipments declined progressively during the last two quarters of 1956, lagging considerably behind vaccine releases. This progressive accumulation of vaccine available for use is also shown in figure 7.

Of the 98.2 million doses distributed domestically, 13.7 million were purchased by the National Foundation for Infantile Paralysis, primarily for vaccination of first- and second-grade school children in 1955, 53.5 million were distributed through public agencies, and 31.0 million were distributed through normal drug channels. Specific usage by age group and by first, second, or third inoculation for only a part of this vaccine is known.

There are between 60 and 65 million persons under 20 years of age in the United States and Territories. Just over half enough vaccine has now been distributed to complete three inoculations for each individual in this group. More than 100 million doses in addition would be required to complete vaccination of the population aged 20 to 40.

Discussion and Summary

The experience in the United States during 1956 shows that poliomyelitis vaccine has been safe and effective. Several hundred cases of poliomyelitis occurred shortly after inoculation, but this many vaccine-associated cases could easily be coincidental in view of the more than 70 million doses of vaccine that were administered. The vaccine-associated cases had all the characteristics of naturally occurring poliomyelitis. There was slight, if any, evidence of untoward reactions from the vaccine. While the concepts of absolute vaccine safety or total absence of a provoking effect of inoculation are not scientifically tenable. the epidemiological observations during 1956 indicated that any such hypothetical effects occurred at a frequency of less than one per million inoculations.

During 1956 the effectiveness of the vaccine could not be evaluated in well-controlled field studies, such as Francis conducted in 1954 (*3*), or in large-scale comparison-group studies such as were made in 1955 (*1*). It was necessary to depend largely upon qualitative studies and upon orderly epidemiological inferences based on careful observation and analysis. A number of independent studies consistently point to a level of effectiveness in preventing paralytic cases of 75 percent, with a large proportion of the vaccinated population having received less than the recommended course of three doses. The effectiveness of three doses, properly spaced, has not yet been fully evaluated, but the occurrence of several well-confirmed triple-vaccinated paralytic cases shows it to be less than 100 percent.

Considerable evidence has accumulated to show that the present vaccine is less effective in preventing nonparalytic cases and in controlling the spread of inapparent infection. Two published studies (*4*, *5*), as well as unpublished work of Lipson, Carver, and Robbins and of Davis and Melnick, have shown that vaccinated children in household contact with poliomyelitis cases can readily become infected, although, again, the effect of three doses has not yet been fully evaluated. Thus the primary effect of vaccine appears to be the prevention of invasion of the central nervous system and thereby the prevention of paralysis. This limitation on the effectiveness of the vaccine may be associated with the evidence that poliovirus did spread rather extensively in various populations during 1956, not only in Chicago, but in Louisiana, Utah, Idaho, California, and elsewhere. In spite of relatively widespread, but incomplete, vaccination, these populations experienced high incidence of disease, particularly among preschool children in all socioeconomic groups.

The immediate public health implication of the experience in 1956 is that substantially higher levels of immunity must be achieved among all elements of the population.

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Poliomyelitis Vaccination Program in Richland, Wash.

By DAVID B. ROWLETT, M.D., and CAESAR BRANCHINI, M.A.

IN RICHLAND, WASH., a community of 26,000 population, statistical evaluation of the status of poliomyelitis vaccination, followed by the education of private physicians and cooperation between these physicians and the Richland Health Department, increased the percentage of vaccinated children in the survey from about 56 percent to 80 percent. The term "vaccinated" as used in this paper refers to those children who have received at least one shot of Salk vaccine. Although we realize that one shot confers neither complete nor lasting protection, we assume that children who have received one shot will complete the series.

In the event that other communities attempt to determine their poliomyelitis vaccination status, the statistics obtained in this study may serve as a base point for comparison with their findings.

Setting the Stage

A balance in supply of and demand for the Salk vaccine was not achieved in Richland until the early spring of 1956. During 1955 the vaccine was available in adequate supply but there was no demand for it. Early in 1956, due to the change in public opinion regarding the safety and effectiveness of the vaccine, the demand was rapidly accelerated and the supply fell short. Private physicians developed waiting lists of hundreds of patients who were patiently awaiting the arrival of more vaccine.

Dr. Rowlett is public health officer and industrial physician, and Mr. Branchini is a specialist in health education, Hanford Atomic Products Operation, General Electric Company, Richland, Wash.

The situation was eased about the middle of March. Between March and October 1956 the Richland Health Department, the National Foundation for Infantile Paralysis, and private physicians recommended the Salk vaccine and gave widespread but low-pressure publicity to its safety and effectiveness. The usual methods of dissemination of information were used. Leaflets were distributed through the schools and through the Hanford Atomic Products Operation plant, the chief industry in the Richland area. Newspaper stories were released recommending vaccination and reporting the amount of vaccine available. Radio and television announcements supplemented the information program.

Between March and October 1956 vaccinations were given by private physicians in their offices. When Government-purchased vaccine became available, it, too, was distributed to private physicians for office use. During this period, no clinics were held and no vaccinations were administered by the health department.

Continuous checks showed that the demand for the vaccine exceeded the supply. However, this situation began to reverse itself during September.

Health Department Study

It was at this point that the Public Health Operation of the General Electric Company's Hanford plant (local nomenclature for the Richland Health Department), which operates all Richland municipal facilities for the Atomic Energy Commission, undertook a study to de-

termine the vaccination status of the children of the community. Children of school age and under comprise 42.2 percent of the total population of Richland.

The object of the study was to provide information on the current level of protection against poliomyelitis to help the health department decide whether a change in the vaccination program was needed. The study would also provide basic information from which to determine the effectiveness of the vaccination program and, later, the effectiveness of the vaccinations.

Study Methods

Two groups of children were studied and each group had to be treated differently. The first group was made up of school children. These children were easily reached through our regular school health program, since the public health nurses provide school health services in the community. The second group was made up of preschool children, and information on this group was more difficult to obtain.

A form which explained the advisability of vaccination against poliomyelitis and pointed out the safety and effectiveness of the Salk vaccine was prepared and was given each school child to take home. On the form parents were asked to indicate the number and approximate dates of shots of Salk vaccine received by each child and were offered the opportunity to continue the vaccination program with their private physicians. They were also requested to sign an attached slip if they were interested in administration of the vaccine by the health department.

At each school the public health nurse distributed the forms to the teachers. As is done routinely in other immunization programs, the teachers distributed the forms to the children and collected them when they were returned. The public health nurse collected the completed forms and delivered them to the health department, where the information was consolidated.

A sampling technique was used to obtain details of the vaccination histories of preschool children. In order to reduce the size of the sample, birth certificates of children born during 1952–56 were used to select the sample. To assure anonymity, only the child's address was used, and a letter was mailed to the resident at that address. The letter explained the program and the fact that in order to plan a poliomyelitis vaccination program, information was needed on the vaccination history of all children in the community. Respondents were asked to indicate on an enclosed card the ages of preschool children in the household and the approximate dates when they had received Salk vaccine shots.

The information on the sample of preschool children was combined with the information on school children.

Poliomyelitis vaccination status of children in Richland, Wash., as of October 1956

Grade	Number shots of Salk vaccine received				Total children in program
	0	1	2	3	
Preschool	1,300	150	1,700	100	3,250
Kindergarten	202	31	386	50	669
1	239	29	403	41	712
2	236	25	367	56	684
3	201	12	280	198	691
4	201	23	227	171	622
5	277	12	243	45	577
6	187	32	188	22	429
Junior high school	838	30	401	30	1,299
Senior high school	550	20	151	1	722
Total	4,231	364	4,346	714	9,655

Findings

Information was obtained on 9,655 of the 10,977 children in the preschool and school age groups. The immunization status of the children in the study is shown in the table. Figure 1 shows the percentage of children in each grade who received the designated numbers of shots of Salk vaccine.

Our chief objective was to determine which children had not been vaccinated, in order that we might take steps to achieve a higher degree of protection against poliomyelitis if the collected data indicated a need for greater protection.

The proportion of children who had not been vaccinated, that is, who had not received any shots of Salk vaccine in the poliomyelitis vac-

cination series, was 44 percent. This proportion, however, varied considerably, from a low of 29.1 percent for third grade children to a high of 76.2 percent for senior high school children. The percentage of unvaccinated children in each school grade is shown in figure 2.

Vaccination Program

When the information on the vaccination status of the school children of Richland was tallied, it was decided that, although the level of protection achieved against poliomyelitis was high, it would be desirable to increase this level considerably for two reasons: (*a*) those who by this time had not taken advantage of the opportunity to obtain this protection would not do so voluntarily or, if they did, they would do so only in small numbers; and (*b*) the level of protection in the junior and senior high schools was so inadequate that considerable emphasis needed to be placed on these groups.

A vaccination program was proposed by the health officer of Richland. The plan was discussed with and approved by the local physicians, and the program was undertaken in the schools. Vaccinations were scheduled to be given during the last 2 weeks in October and the last 2 weeks in November 1956. Three groups of children were to receive shots of Salk vaccine:

Figure 1. Percentage of children in Richland, Wash., who received the designated number of shots of Salk vaccine in 1956, by school group, prior to the vaccination program.

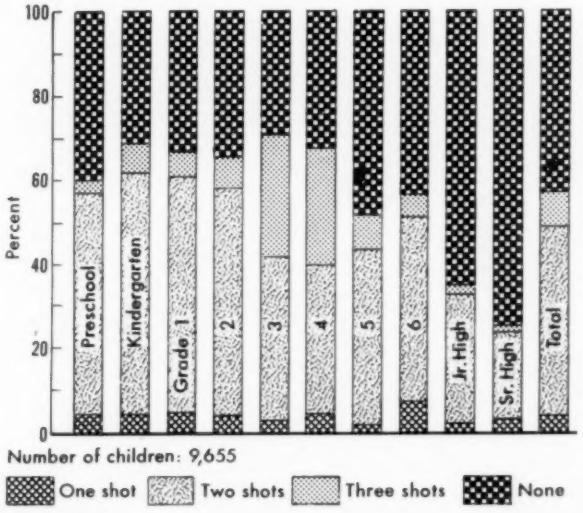
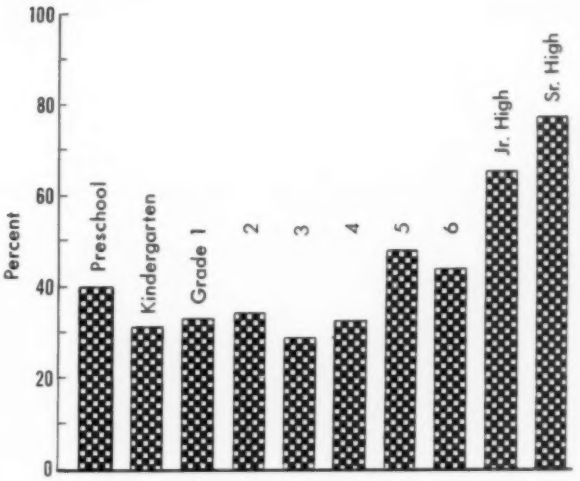


Figure 2. Percentage of children in Richland, Wash., who did not receive Salk vaccine in 1956, by school group, prior to the vaccination program.



1. Children who had received no previous shots would be given one shot in October and a second shot in November.

2. Children who had received only one shot, if it was given from 2 weeks to 6 months before either vaccination period, would be given their second shot during the October or November immunization schedule.

3. Children who had received two shots 7 months or more before October 1956 would be given their third shot during either of the vaccination periods.

In the secondary schools public health nurses discussed the safety and effectiveness of the vaccine in meetings with the students. The National Foundation for Infantile Paralysis film "Unconditional Surrender" was shown to all students, and a 15-minute television program was devoted to a discussion of the need for immunization among secondary school students.

The first half of the poliomyelitis vaccination program in the Richland schools was completed in November. Of the total population of school age and under, 80 percent have received at least one shot in the Salk vaccine series. The level of vaccinated children in the high school is 64 percent. Of the junior high school group, 80 percent have received at least one shot of vaccine; of the elementary school pupils, 87 percent.

These percentages are based on the assumption that all of those who have not responded to the questionnaire have not received any shots.

Summary

A study to determine the poliomyelitis vaccination status of all children of school age and under was carried out in 1956 in Richland, Wash., a community of 26,000 population. Through the close cooperation of private physicians and the health department, 80 percent of the children in the age groups studied received Salk vaccine.

Cost Study of Poliomyelitis Vaccine Injections

A time and cost study in the Tri-County, Colorado, District Health Department found that the average cost of administering poliomyelitis vaccine in public poliomyelitis vaccination clinics of that department in 1956 was 26.5 cents for each injection, not including vaccine cost. The study was carried out by the staff of the Region 8 office of the Public Health Service in Denver.

The Tri-County District Health Department, directed by William S. Haynes, M.D., M.P.H., has jurisdiction over the three counties surrounding Denver—Adams, Arapahoe, and Jefferson. The vaccination clinics were held principally in the department's branch health centers in each county.

There were 112 clinic sessions in which 50,585 injections were given. The total cost of the clinics in 1956 was $13,425.23, consisting of $5,856.54 direct costs, $4,037.19 nursing costs, and $3,531.50 health department general overhead costs.

Direct costs cover expenditures for specialized poliomyelitis vaccine clinic supplies and equipment, fees to physicians (on an hourly rate) for administration of the vaccine, salaries of part-time clinic nurses, and salary of a clerk working exclusively with the poliomyelitis vaccination program. The vaccine, which was furnished by the Colorado Department of Public Health, was purchased with Federal grant-in-aid funds available to Colorado under the Poliomyelitis Vaccination Assistance Act of 1955.

The nursing cost item includes the cost of nursing services furnished by the visiting nurse services of the Tri-County Department to the public clinic program. It covers a part of the health department overhead costs allocated to the nursing service and the salary value of productive work by students in the clinics.

The pro rata share of health department overhead costs covers an allocation of these costs on a dollar pro rata basis computed on direct costs against overhead costs, excluding those allocated to nursing.

The overhead costs include the salary and travel costs of the health officer, clerks, and administrative staff; capital outlay; janitor and office supplies; medical and clinical supplies; building maintenance; telephone; postage; printing; estimated rental value of space used in publicly owned buildings; per diem payments to board of health members; and attorney fees.

"Housewife" volunteers devoted about 1,000 hours of service to the program. This service, if valued at $1 per hour, would raise the cost of each injection by 2 cents.

use of general hospitals

Demographic and Ecologic Factors

MAURICE E. ODOROFF, M.A.
LESLIE MORGAN ABBE, B.S.

Drawn from data compiled in a national household survey, this report gives provisional findings on current levels of general hospital use in relation to personal and geographic characteristics.

PLANNING for general hospitals has included a continuing search for valid standards of need. In 1947 uniform standards for the number of beds needed came into general use with the development of statewide hospital plans under the Hospital Survey and Construction (Hill-Burton) Act. These standards reflected the consensus of judgment of the period. They were largely lacking a base of actual experience in the needs of a population whose characteristics were known (*1*). During the subsequent decade the Nation's general hospital plant has increased by one-fourth, or more than 150,000 beds. At the same time changing techniques in the care and prevention of disease and illness have modified requirements for the physical facilities to insure adequate care. It is now essential to reassess these requirements.

Mr. Odoroff is chief, and Mr. Abbe is assistant chief, Program Evaluation and Reports Branch, Division of Hospital and Medical Facilities, Public Health Service.

As a first step in defining more precisely standards of need for general hospitals, the Public Health Service, through its Division of Hospital and Medical Facilities, has contracted for a survey of the present level of use of general hospitals. The data on use have been matched with data on personal characteristics and geographic and economic factors. Such a study permits identifying the circumstances which accompany varying levels of use and points the way to more intensive studies of real need. It achieves a link with the population served that cannot be had through studies of hospital records alone, since these records cover only those who choose to use the hospital.

Description of Study

The study of general hospital use is based on a sample household survey on a national scale. It was conducted by the Bureau of the Census through supplemental questions asked in its regular monthly current population survey.

This survey provides official Government statistics on total employment and unemployment, as well as periodic data on many other social and economic characteristics of the population (*2, 3*). The sample used in the survey of hospital use was drawn from the civilian, noninstitutional population living within the continental United States. It did not include members of the armed services or inmates of penal and mental institutions or of homes for the aged, infirm, and needy. It includes about 27,000 households (three-fourths of the regular sample size of the current population survey), consisting of about 90,000 persons of all ages. The sample was spread over 330 areas comprising 638 counties and independent cities, with coverage in each of the 48 States and the District of Columbia. The survey was made in September 1956 after a pretest in Philadelphia in June 1956, which included about 650 households and 2,100 persons.

For each family a history was obtained of hospitalization and outpatient care received by each of its members during the previous 12-month period. The questions asked sought to learn how frequently, how long, for what conditions, and in what hospitals or related facilities such care was obtained. Personal characteristics, such as residence address, sex and race, age, veteran status, and occupation, were identified through the standard inquiries of the regular monthly current population survey.

In addition, economic data were obtained for each household, showing income level, status with respect to hospital insurance coverage, and methods of payment for hospital care received. Particular attention was given to determining the place of care with respect to the type of place of residence (metropolitan, urban, or rural) of the patient. Throughout the study the terminology used follows standard definitions of the Bureau of the Census (*4*).

Certain limitations of the data must be noted. Institutional population is excluded for practical reasons arising from the method of survey. Also, any approach to reporting by household survey for a 12-month prior period of time fails to include a record of persons who used hospital care during the past year, but who died, emigrated, or entered the armed services before the survey date.

The figures reported are estimates based on a sample. Accordingly, they may differ somewhat from the figures that would have been obtained if a complete census had been taken, using the same questions, instructions, and enumerators. Sampling variability may be relatively large when the estimates and differences between estimates are small. The degree of variability will be calculated for selected items according to standard statistical procedures. As in any survey work, the results are subject to errors of response and reporting.

Scope of the Report

Because of the general interest indicated by a number of national groups and others, this report is published as an interim account of results before all data have been tabulated or analyzed. The data appearing are selected highlights. They relate only to levels of hospital use matched against personal characteristics and geographic circumstances of residence and place of care. They will need further study and analysis in relation to other data of the survey. Additional interim reports will cover (*a*) limited data on outpatient visits and the accompanying circumstances, (*b*) income of all families and individuals in the

Table 1. General hospital use, by sex and race

Race	Both sexes	Male	Female
	Annual admissions per 1,000 population		
All persons	101	76	124
White	104	79	128
Nonwhite	72	49	93
	Average stay per admission, in days		
All persons	8. 1	10. 1	6. 8
White	8. 0	9. 9	6. 8
Nonwhite	9. 1	12. 6	7. 3

Table 2. General hospital use, by age

Age groups, in years	Annual admissions per 1,000 population	Average stay per admission, in days
All ages	101	8. 1
Under 14	54	5. 2
14–24	119	5. 5
25–34	162	6. 1
35–44	109	8. 4
45–54	93	9. 9
55–64	104	12. 8
65 and over	125	14. 0

sample in relation to their levels of general hospital use, and (*c*) the proportion of hospital insurance coverage reported for all persons in the sample, matched with various personal, geographic, and economic circumstances. It is planned to publish a comprehensive report of the study as a monograph.

Two basic measures of the level of hospital use in varying circumstances have been compiled from the survey data. These are annual admissions per 1,000 population and average stay in days per admission. In this report, these two measures describe the relation between hospital use and a group of personal characteristics that may be considered demographic factors. They also describe the relation between use and a group of factors pertaining to the nature of the geographic and social setting of the place of residence and the place of care. For the purposes of this study, these factors are classed as ecologic factors.

Table 3. General hospital use among males 14 years old and over, by veteran status and type of hospital

Veteran status and type of hospital	Annual admissions per 1,000 population	Average stay per admission, in days
All males 14 years old and over	83	11. 7
Veterans	84	12. 8
World War II veterans	80	11. 9
In Federal hospitals	10	28. 2
In non-Federal hospitals	70	9. 5
Other veterans	90	14. 3
In Federal hospitals	15	33. 6
In non-Federal hospitals	75	10. 4
Nonveterans	82	11. 0

Demographic Factors

Sex and race result in marked differences in general hospital use for the population surveyed (table 1).

Annual admissions per 1,000 population total 101 for all persons. For females the rate (including maternity cases) is about one-fourth higher; for males, about one-fourth lower. The rates for the nonwhite population of both sexes are substantially lower than those for white persons.

The average stay for all persons is 8.1 days, with differentials by sex about as great as for admissions, but in the opposite direction.

Table 4. General hospital use among persons 14 years old and over, by employment status and industry

Employment status and industry	Annual admissions per 1,000 population	Average stay per admission, in days
All persons 14 years old and over	120	8. 6
In labor force	82	8. 5
Employed	81	8. 4
Agriculture	57	8. 2
Wage and salary workers	56	10. 2
Self-employed workers	56	8. 4
Unpaid family workers	60	5. 5
Nonagricultural industries	84	8. 4
Wage and salary workers	84	8. 5
Mining [1]	138	7. 8
Construction	68	8. 5
Manufacturing	80	8. 5
Transportation, etc	98	11. 1
Trade	83	8. 5
Services	85	7. 6
Private households	57	8. 9
Professional services	107	7. 4
Other services	73	7. 5
Public administration	94	8. 6
Self-employed workers	84	8. 1
Unpaid family workers	113	5. 3
Unemployed	97	10. 6
Not in labor force	174	8. 7
Keeping house	199	6. 4
Going to school	48	7. 3
Unable to work	239	25. 6
Other nonworkers	179	16. 1

[1] Includes forestry and fisheries.

Women are admitted more frequently than men, but stay a shorter time.

Age affects substantially the pattern of admissions and average stay in general hospitals (table 2).

For children under 14 years of age the admission rate of 54 per 1,000 population is only slightly more than one-half the rate for all ages. It rises steadily, by 10-year age groups, to a rate of 162 for ages 25–34 (the principal childbearing age group). The rate then declines to 93 for the age group 45–54 and rises thereafter. For the group aged 65 and over, the rate for the sample study is 125 per 1,000 population.

Average hospital stay for the childhood group is reported at 5.2 days, rising gradually to a maximum of 14.0 days for persons 65 years and older.

Veteran status has little effect on admissions and average stay, according to the record for all males 14 years of age and older (table 3).

Veterans of World War II have an admission rate of 80 per 1,000 population and an average stay of about 12 days, in comparison with a rate for other veterans of 90 admissions and a stay of about 14 days.

Both groups of veterans are receiving care principally in non-Federal hospitals. The typical stay for veterans in Federal hospitals is from 4 to 5 weeks; it is about 10 days in non-Federal hospitals.

Employment status and industry produce substantial differences in admissions, with varying effect on average stay for specific industries and employment groups (table 4).

For all persons 14 years of age and over, annual admissions are at a rate of 120 per 1,000 population. For those in the labor force, the admission rate is 82. The rate drops to 57 for those in agriculture and rises to 97 for the unemployed group and 138 for persons in mining (including forestry and fisheries). For persons not in the labor force (homemakers, students, the disabled, and others), the combined admission rate is 174. Persons classified as unable to work have an admission rate of 239, with an average stay of 26 days.

Table 5. General hospital use, by region and type of residence

Region	Type of residence			
	All residences	Urban	Rural	
			Nonfarm	Farm
	Annual admissions per 1,000 population			
All regions	101	100	112	83
Northeast	96	94	106	80
North Central	99	98	109	87
South	102	107	112	77
West	111	103	130	111
	Average stay per admission, in days			
All regions	8.1	8.7	6.9	7.4
Northeast	9.7	10.5	7.5	8.6
North Central	8.1	8.6	6.7	8.7
South	7.0	7.2	7.0	6.6
West	7.5	8.1	6.6	5.8

Ecologic Factors

Geographic region and type of residence have a considerable effect on admissions and average stay (table 5).

Admissions of persons who live on farms are consistently lower than other admissions. Nationally, the admission rate for farm people is one-sixth less than for the total population. This differential holds for 3 of the 4 broad regions of the country. In each region, the highest level of admissions is for rural nonfarm residents.

Type of residence and place of care, as they reflect accessibility, materially affect levels of hospital use (table 6). To assist in interpreting this complex relation, a third measure has been introduced. Not only does the study identify the place of residence of the patient according to whether it is metropolitan, urban, or rural and compare levels of use for a related array of places of care, but it also identifies the median distance traveled for care from each type of residence to each type of place of care.

Particular effort has been made to discover

Table 6. General hospital use, by residence and place of care

Residence	Place of care						
	All places	Standard metropolitan areas [1]			Urban (nonmetropolitan)		Rural
		Metropolitan area of residence		Other metropolitan areas	Places 10,000–50,000	Places under 10,000	
		Central city	Outside central city				
	Annual admissions per 1,000 population						
All areas	100	39	12	11	20	14	5
Metropolitan areas	97	68	21	5	2	1	(2)
Central city	95	85	5	3	1	1	(2)
Urban fringe	95	46	41	5	2	(2)	1
Rural nonfarm	107	59	33	10	4	2	(2)
Rural farm	83	51	20	5	5	4	(2)
Urban (nonmetropolitan)	115			18	61	34	2
Places 10,000–50,000	117			18	93	4	2
Places under 10,000	113			18	23	69	3
Rural (nonmetropolitan)	100			18	34	30	18
Nonfarm	113			20	41	33	20
Farm	81			16	25	27	14
	Average stay per admission, in days						
All areas	8. 1	9. 2	7. 5	11. 4	6. 6	6. 3	5. 4
Metropolitan areas	9. 1	9. 2	7. 4	12. 5	10. 5	6. 0	4. 9
Central city	10. 1	9. 9	9. 0	17. 6	11. 3	6. 9	4. 4
Urban fringe	8. 3	8. 3	7. 6	12. 0	13. 8	2. 9	5. 2
Rural nonfarm	7. 2	7. 5	6. 0	8. 4	8. 7	7. 2	(2)
Rural farm	6. 8	7. 8	6. 0	4. 6	3. 2	3. 9	(2)
Urban (nonmetropolitan)	6. 9			10. 9	6. 4	6. 0	5. 1
Places 10,000–50,000	7. 2			11. 8	6. 3	5. 4	7. 5
Places under 10,000	6. 7			9. 8	6. 5	6. 1	3. 5
Rural (nonmetropolitan)	7. 1			11. 1	6. 3	6. 5	5. 4
Nonfarm	6. 8			10. 3	6. 1	6. 3	6. 0
Farm	7. 5			12. 6	6. 9	6. 8	4. 2
	Median distance traveled per admission, in miles						
All areas	7. 4	6. 2	6. 1	40. 1	7. 7	8. 6	8. 6
Metropolitan areas	6. 5	6. 2	6. 1	23. 6	21. 6	16. 9	(2)
Central city	5. 6	5. 4	6. 4	55. 0	9. 0	(2)	(2)
Urban fringe	6. 6	6. 8	5. 8	72. 3	(2)	(2)	(2)
Rural nonfarm	10. 1	12. 5	6. 6	17. 9	17. 5	(2)	(2)
Rural farm	11. 5	11. 7	(2)	(2)	(2)	(2)	(2)
Urban (nonmetropolitan)	6. 5			37. 2	5. 8	5. 8	15. 7
Places 10,000–50,000	5. 9			18. 4	5. 3	11. 9	(2)
Places under 10,000	7. 5			53. 8	11. 6	5. 6	(2)
Rural (nonmetropolitan)	13. 3			47. 2	10. 7	12. 7	8. 2
Nonfarm	10. 5			36. 5	9. 1	10. 8	7. 8
Farm	18. 1			59. 4	18. 1	15. 5	9. 2

[1] Includes a central city of at least 50,000 population with contiguous counties socially and economically integrated therewith, as defined by the Bureau of the Census (*4*).

[2] Insufficient number of cases to justify entry.

NOTE: Discrepancies in totals result from rounding.

the present pattern of use in metropolitan areas, with respect to the large population groups now found in the fringe areas outside the central city. This is a secondary problem in broad planning for general hospital needs on which very little factual evidence has been available. The urban fringe includes both urban places and unincorporated urban areas.

This survey shows the following principal facts about the relation between place of residence and place of care in affecting levels of use:

- The total admission rate by residence varies from 81 for persons living on farms not in metropolitan areas to 117 for persons living in urban places below 50,000 population.
- The residents of metropolitan areas report an admission rate of 97. Persons living in rural nonfarm residences in metropolitan areas report a rate higher than the metropolitan area average, namely, 107. Residents of the urban fringe in metropolitan areas report an admission rate to the central city of only 46 per 1,000 population, or less than one-half of

Table 7. General hospital use, by reason for admission and place of care

Reason for admission	Place of care					
	All places	Standard metropolitan areas [1]		Urban (nonmetropolitan)		Rural
		Central city	Outside central city	Places 10,000–50,000	Places under 10,000	
	Annual admissions per 1,000 population					
All reasons	100	48	14	19	14	5
Surgery	25	13	3	5	3	1
Obstetrics	22	10	3	4	3	1
Pediatrics	16	8	2	3	2	1
Accidents	6	3	1	1	1	[2]
Other	32	14	4	7	5	2
	Average stay per admission, in days					
All reasons	8. 1	9. 6	7. 5	6. 6	6. 3	5. 4
Surgery	10. 6	13. 0	8. 8	8. 4	7. 2	8. 0
Obstetrics	4. 5	4. 8	4. 7	4. 2	4. 0	4. 0
Pediatrics	5. 2	6. 0	4. 3	3. 8	4. 4	3. 2
Accidents	12. 1	15. 3	10. 9	8. 4	9. 3	4. 1
Other	9. 3	11. 2	9. 9	7. 6	7. 4	6. 4
	Median distance traveled per admission, in miles					
All reasons	7. 4	7. 3	6. 3	7. 7	8. 6	8. 6
Surgery	7. 8	8. 1	6. 4	8. 1	8. 9	6. 7
Obstetrics	6. 9	6. 6	6. 1	6. 9	8. 5	9. 5
Pediatrics	7. 2	7. 3	6. 1	7. 1	8. 3	7. 7
Accidents	7. 8	7. 2	6. 9	8. 0	10. 2	8. 3
Other	7. 5	7. 2	6. 3	8. 1	8. 4	9. 2

[1] Includes a central city of at least 50,000 population with contiguous counties socially and economically integrated therewith, as defined by the Bureau of the Census (*4*).

[2] Insufficient number of cases to justify entry.

NOTE: Discrepancies in totals result from rounding.

the total hospital admissions for this residence group. For rural parts of standard metropolitan areas, the admission rate to the central city is 59 for nonfarm residents and 51 for farm residents.

- Residents of urban nonmetropolitan communities have about 18 percent of their total admissions in a metropolitan area. A substantial proportion of admissions for persons living in smaller urban places (under 10,000 population) is in hospitals of larger communities.
- Residents of rural areas (that is, areas where all places are under 2,500 population) report that only 18 percent of their admissions are in hospitals located in rural areas; another 30 percent are in places under 10,000 population.
- The average stay of central city residents in metropolitan areas is greater than the stay of people who come from elsewhere in the area.
- Persons living outside of metropolitan areas report an average stay considerably below that of people who live in metropolitan areas, except when they go to a metropolitan area for care. Such stay for nonmetropolitan residents averages about 11 days in metropolitan hospitals, as compared with 6 days in hospitals nearer home.
- Farm residents cared for in rural hospitals report an average stay of only about 4 days.
- The median distance traveled by each group does not vary greatly from the national average of 7.4 miles, except for persons receiving care in a metropolitan area which is not their place of residence. Such travel amounts to 40 to 50 miles or more.

Reasons for admission in relation to place of care show relatively less diversity in level of use than do places of residence in relation to place of care (table 7).

Surgery accounts for 25 percent of all admissions, and obstetrics for 22 percent.

Average stay for surgery is 10.6 days and for accidents 12.1 days, as compared with about 5 days for obstetric and pediatric services and an average for all reasons of 8.1 days.

Summary

The Public Health Service is investigating the level of use of general hospitals by a known population, for which selected demographic, ecologic, and economic data are collected. For this purpose, the resources of the Bureau of the Census have been employed in connection with household interviews of its current population survey. The sample used comprises about 27,000 families, including about 90,000 persons of all ages, which is three-fourths of the current population survey sample. The study is intended as a first step in defining standards of need for general hospital beds by identifying the circumstances which accompany varying levels of use.

This interim report records provisional findings on levels of general hospital use in relation to (*a*) selected factors of personal characteristics of the population surveyed and (*b*) geographic factors pertaining to location and urban-rural residence of the patients cared for. It also reports on use according to the accessibility of the place of care, as related to the place of residence of the patient, and according to the reason for admission. Special significance attaches to the data describing the level of use provided within the central city of a metropolitan area for patients coming from its urban and rural fringe.

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Miss Switzer

Dr. Dauer

Dr. Cohen

Dr. Top

New Members of the PHR Board of Editors

Four new members have joined the Board of Editors of *Public Health Reports*. Replacing Dr. Gaylord W. Anderson, Dr. Halbert L. Dunn, Dr. Martha M. Eliot, and Dr. Basil C. MacLean, the appointees will serve on the 13-member board for 3 years ending in 1959.

Mary E. Switzer, who became director of the Federal Office of Vocational Rehabilitation in 1950, was instrumental in developing the expanded vocational rehabilitation law passed unanimously by Congress in 1954. This legislation has united the public and private nonprofit restoration organizations with the States in attacking disability problems. Miss Switzer, long outstanding in her national and international health work, was presented with a distinguished service award by the Department of Health, Education, and Welfare in April 1956. Previously, she had received the National Rehabilitation Association President's Award. Miss Switzer has also been awarded the honorary degree of doctor of humane letters by Gallaudet College, District of Columbia, and Tufts University, Medford, Mass.

Carl C. Dauer, M.D., M.P.H., has been medical adviser to the National Office of Vital Statistics, Public Health Service, since 1950. He received his medical degree from Western University in 1920, and graduated from the Harvard School of Public Health in 1933. Dr. Dauer began his public health career as director of child hygiene with the Marion County Health Department, Salem, Oreg., in 1930. Subsequently, he served as an instructor and assistant professor in preventive medicine at Tulane University and as director of the bureau of preventable diseases, District of Columbia Department of Health. He has held teaching positions at the Catholic University, Georgetown University, and George Washington University Medical Schools. Dr. Dauer, whose contributions to medical literature have been extensive, is a member of the American Epidemiological Society, the Washington Academy of Sciences, the Public Health Service Psittacosis Board, a fellow in the Epidemiology Section of the American Public Health Association, and a diplomate of the American Board of Preventive Medicine.

Mandel E. Cohen, M.D., is on the staff of the Massachusetts General Hospital in Boston and of the department of neurology at the Harvard Medical School. Concurrently, he serves as consulting neuropsychiatrist for the Army, the Public Health Service, and Los Alamos Medical Center. A graduate of Johns Hopkins Medical School, Dr. Cohen received his training largely at the Boston City Hospital and the Massachusetts General Hospital. He was a member of the Department of Medicine and Psychiatry at the Harvard Medical School in 1945, and the following year joined the staff of Tufts Medical School as research professor of psychiatry. His published works include reports on studies of hysteria, neurocirculatory asthenia, epilepsy, manic-depressive disease, heart disease, and vascular disease of the brain.

Franklin H. Top, M.D., is a faculty member of the State University of Iowa, where, since 1952, he has been director of the department of health and head of hygiene and preventive medicine. In the same period, he has also acted as consulting director of the Iowa State Hygienic Laboratories, Iowa City, as well as consultant in infectious diseases at the hospital of the State University of Iowa. He is also director of the Institute of Agricultural Medicine, established in 1955. After graduation from the University of Pennsylvania Medical School in 1928 and the Johns Hopkins School of Hygiene and Public Health in 1935, Dr. Top began his professional career in the Herman Kiefer Hospital in Detroit, becoming hospital director in 1947. During the 2 years spent as professor of epidemiology and pediatrics at the Universty of Minnesota College of Medical Sciences, Dr. Top edited the History of American Epidemiology by C.-E. A. Winslow and associates, 1952. He is also the author of the standard work, Communicable Diseases, 1941, 1947, 1955.

Expenses and Income Sources of Dental Students

By SHAILER PETERSON, Ph.D., and WALTER J. PELTON, D.D.S., M.S.P.H.

THE NUMBER of dentists in active practice in the United States rose by almost 5,000 between 1930 and 1955. Despite this numerical gain, the supply of dentists in proportion to population continuously declined. In 1930, there was 1 dentist for every 1,728 persons in the Nation; by 1955, there was 1 dentist to 2,168 persons. A continuation of this adverse trend through the next 20 years will result in the most unfavorable dental manpower supply this country has had since the beginning of the century.

The failure of the dental manpower supply to keep up with population growth has occurred during a period in which dental schools have been training the largest numbers of students in their history. In the 10-year period between 1940 and 1950, enrollments increased by more than 50 percent, to reach an average of almost 12,000 students a year. Enrollments have continued to rise in each year since 1950 but not fast enough to reverse the pattern of shortage. They must be drastically increased to provide enough dentists to care for a larger population and to meet the rise in the level of individual demand for care which is expected to accompany population growth.

Dr. Peterson is secretary of the Council on Dental Education, American Dental Association. An authority on educational research and measurement in dental education, he has served as director of educational measurements of the council and was on the examination staff of the Armed Forces Institute at the University of Chicago. Dr. Pelton is chief of the Division of Dental Resources, Public Health Service, a position he has held since 1951.

The need for raising dental school enrollments poses some serious financial problems for the schools, for the students, and for dentistry as a whole. A study conducted in 1952 (*1*) revealed that dental schools had large backlogs of equipment and building needs which could not be met because of a lack of sufficient funds. Increases in tuition had done no more than keep pace with postwar inflation. A further rise in tuition would provide some relief for the schools, whose financial difficulties have been aggravated by expanding enrollments. Administrators, however, fear that substantial increases in tuition would inhibit enrollment, and therefore hesitate to place further financial obstacles in the way of qualified students.

That dental education is already a very expensive undertaking for the student is shown in a recently published study of the financial problems of dental students conducted by the Council on Dental Education of the American Dental Association and the Division of Dental Resources of the Public Health Service (*2*). This investigation, together with the earlier study on the financial status of the schools, provides a foundation for the planning of effective corrective measures which will alleviate the schools' financial problems. It can also serve as a guide in the reappraisal of tuition charges and the establishment of expanded scholarships and other programs of financial aid for students.

Survey Methods

In May 1954, the ADA Council on Dental Education, with the cooperation of dental

school deans, distributed questionnaires to the 12,516 students enrolled in the country's 43 dental colleges. Students were asked to estimate their expenditures for the 1953–54 school year and to designate the source of funds used to meet these expenses. They were also asked to supply information regarding personal and family characteristics, types of living arrangements, and proposed sites of future practice.

Survey schedules were returned by all of the 26 privately financed schools and by 13 of the 17 publicly financed schools. Enrollments in these 39 colleges amounted to about 90 percent of the entire student body. Of the 4 nonreporting public schools, 2 were located on the Pacific coast and 2 in the North Central States. Schedules were completed by 87 percent of all private school students and 58 percent of all public school students, for a total participation of 76 percent. The data pertaining to the characteristics of students and to their financial problems are summarized here.

A Changing School Population

The present dental school population is in a phase of transition. The veteran enrollments marking the immediate postwar period are now on the decline, and as a result there has been a lowering of the average age level of dental students as well as a decrease in the number of married men among the student population.

Despite the downward trend in average age, today's students are still older than their prewar counterparts and are more likely to be married. They enter school with more predental education than their predecessors. The majority are from families whose annual incomes are well above the national average, and their fathers are likely to be in professional or managerial occupations.

The occupational background of parents and the level of family income apparently are factors influencing the choice of dentistry as a career. One in every nine students has a dentist father; nationally, 1 in every 500 men in the labor force is a dentist. Only about one-third of all dental students are from families with annual incomes of less than $5,000, an income group represented by four-fifths of the families in the United States.

Among dental students from low-income families, the proportion of veterans, who are eligible for financial assistance under the GI bill, is relatively higher than the proportion of nonveterans. The GI bill has proved to be a patent factor in stimulating enrollments of qualified students from low-income groups.

Cost of Dental Education

In estimating expenditures for the 1953–54 academic year, dental students were asked to list both school and living expenses. School expenses included amounts spent either by the student or on his behalf for tuition and fees, textbooks, instruments, equipment and supplies, organization dues, and other related expenses. Living expenses covered sums paid for rent, food, clothing, recreation, personal maintenance, health services, travel, and miscellaneous expenses of the students and any dependents in their households. Students living with parents or friends listed only their out-of-pocket expenses for these items.

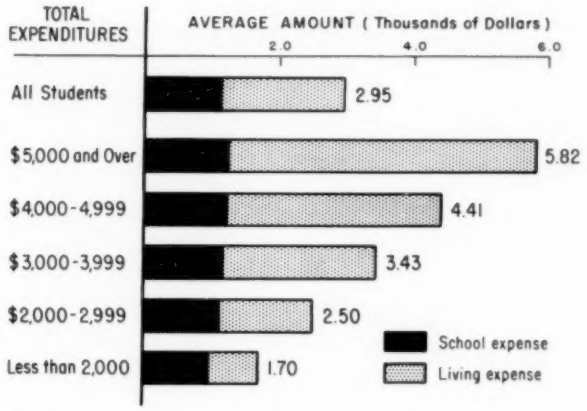
Annual expenses reported by the different categories of students in each of the four classes in school in 1953–54 were projected as 4-year totals in order to estimate the complete cost of a dental education.

A review of these estimates shows that the cost varies from student to student and from school to school. The differences in the levels of total expenditures are largely the result of variations in living expenses, which range over a wide scale of values while school expenses fluctuate only moderately. The highest average school costs reported by any category of students are only one-fourth greater than those at the lowest level, but the highest average living expenses are six times as great as those at the lowest level (see figure). The most striking differences in living expenses are those associated with marital status and living arrangements, factors having no appreciable effect on the levels of school expense (table 1).

School Expenses

For the student body as a whole, the average cost of 4 years in dental school was $11,814. Of this amount, $7,349 covered living expenses,

Average expenditure of dental students, 1953–54.



and $4,465, or 38 percent, was charged to school expense. Tuition and fees represented the largest item of school expense, accounting for more than half of the total. Next in importance came equipment and supplies, for which the average student spent almost a third of his school funds. Books accounted for less than 7 percent, and the remainder was spent on such items as fraternity dues and examination fees.

School expenses were rarely distributed evenly over the 4 college years. In the majority of reporting schools, expenditures reached their peak in the sophomore year and then declined; in many cases, school costs in the senior year were no more than half the amount recorded in the peak year. This uneven distribution was generally caused by the timing of major purchases of equipment and supplies. Some students substantially reduced total school expenses by renting, rather than purchasing, much of the needed equipment.

School costs in private schools were greater than those in public schools. Most of the difference was attributable to charges for tuition and fees, which were 45 percent higher in private colleges. In addition, the equipment, supply, and book bill was higher for the private school student.

There were also regional variations in the levels of school expenses. In the Northeast, where tuition and fees were highest, the student spent $5,113 over 4 years. School expenses averaged $4,842 in the West, where expenditures for tuition and fees were below the northeastern level, but equipment and supplies were higher. Average expenditures were $4,241 in the South and $4,122 in the North Central States. Tuition and fees were slightly lower in the South than in the North Central States, but equipment and supplies cost more.

Living Costs

Since living expenses amounted to 62 percent of the average student's budget, they were much more important than school expenses in determining the total cost of a dental education. Within the framework of living costs, food and housing required the largest outlays, with food accounting for one-third and housing for one-fifth of all expenditures. Personal maintenance and recreation were other large items, constituting one-fourth of the budget. Health and medical care cost comparatively little, averaging about 3 percent for all students, and many of them failed to list it at all.

Unlike school expenses, living costs increased progressively throughout the 4 years. The upward trend resulted from a combination of gradually expanding expenditures by both married and single students and a progressively larger proportion of married students in each of the higher classes.

Living costs, like school costs, tended to be higher for private school students. The exception to this pattern appears to be the single

Table 1. Average 4-year expenditures of dental students, 1953–54

Category of student and type of school	Number of students	Average expenditures		
		Total	School	Living
All students	9, 521	$11, 814	$4, 465	$7, 349
Private	6, 777	12, 037	4, 780	7, 257
Public	2, 744	11, 262	3, 682	7, 580
Married	4, 165	14, 452	4, 410	10, 042
Private	2, 771	14, 923	4, 761	10, 162
Public	1, 394	13, 510	3, 712	9, 798
Single, away from home	3, 825	10, 341	4, 428	5, 913
Private	2, 680	10, 814	4, 754	6, 060
Public	1, 145	9, 237	3, 660	5, 577
Single, at home	1, 531	8, 295	4, 697	3, 598
Private	1, 326	8, 426	4, 862	3, 564
Public	205	7, 448	3, 633	3, 815

student who lived at home while attending dental college, presumably because somewhat smaller shares of living costs were reported as expenditures.

Regional variations in living costs did not affect all categories of students in the same way. Costs were highest in the West for the married student ($10,626) and the single student living away from home ($6,203). The South was most expensive for the single student living at home ($4,146).

The greatest variations in the levels of living expense are the result of marital status and housing arrangements, and for this reason the cost involved in seeking a dental education is much greater for the married student than for the single student, and the single student away from home has more expense than the student who lives with his parents.

The Married Student

At the time of the study, about 44 percent of the students were married, and nearly half of these had children. The proportion of married students increased progressively from 31 percent of the freshman class to 63 percent of the seniors. Since marital status is associated with age, it is not surprising that relatively more veterans were married than nonveterans. Two-thirds of the veterans in the freshman class were married; by the senior year, the proportion was 3 out of 4.

Among nonveterans, one-fifth of the freshmen were married; the proportion increased to 50 percent by the senior year. The fact that so many of the nonveterans are married men is an important factor in the future planning of housing facilities. Although the proportion will decline with the withdrawal of the veterans from campus, the number of married students is likely to remain well above the prewar level and perhaps at the current figure for nonveterans. Schools should therefore plan for a relatively large proportion of married students as a permanent part of dental school enrollments.

For the married student, the total cost of 4 years in school averaged $14,452. His school expenses amounted to $4,410, a figure very close to the all-student average. However, living expenses, which totaled $10,042, were more than $2,500 above the figure for all students, and over $4,000 higher than the amount spent by single students living away from home. Most of the added expense could be traced to the higher cost of food and lodging.

Seven out of eight married students had established their own home either in houses or apartments, and the cost was two and one-half times as great as that for single students away from home. Food bills were from 25 to 50 percent higher. Purchases associated with furnishing and maintaining a home resulted in miscellaneous expenditures 4 times as great as those of the single student.

The presence of children in the home did not bring any substantial increase in overall costs for the married student, although certain differences in the allocation of expenditures developed. Where there were no children, the average cost of housing was $2,479, or about 25 percent of all living expenses, and food purchases required $2,637 (27 percent). For the student with children, food bills rose to $3,259 (32 percent) and less was spent for housing ($2,354 or 23 percent). The presence of children meant larger outlays for health and medical care, which rose to $592, while the childless student spent only $313. The added cost for health services for the student with children was offset by his lower expenditures for personal maintenance and recreation. Because of this tendency to meet higher expenses in one area with lower expenses in another, total living costs for the married student with children averaged only $444 more over 4 years than those of the student who had no children.

The Single Student

Fifty-six percent of all dental students were single. One out of four of them lived at home while attending school, and by doing so substantially reduced the cost of their education. The remaining 75 percent had accommodations in dormitories and fraternity houses on the campus or in rooms and apartments nearby.

The student living away from home had total expenditures averaging $10,341, and since this amount reflects essentially the total cost of all items of school and living expense, it pro-

vides a more accurate measure of the amount a single student pays for his education than would an average for all single students. His school expenses averaged $4,428 and were slightly higher than those of the married student, but his living costs, which totaled $5,913, were 41 percent less. Food bills were $2,115, and, although this was far below the amount reported by the married student, it represented a larger share of total expenditures (36 percent). Housing was also cheaper, averaging $1,063 (20 percent). He was able to devote a third of his budget to personal maintenance and recreation, dividing nearly $1,800 between the two. Payments for health and medical care averaged only $77 for the 4 years.

The cost of education for the single student who lived with his parents was $8,295, the lowest average recorded for any category of students. For this student alone, school expenses were greater than living costs. School expenses, which averaged $4,697, were also higher than those of other students, primarily because a relatively larger proportion of students who lived at home were enrolled in private schools and paid more for tuition and fees. However, his living costs were not only much lower than those of other students but were distributed in a different way. The total living expenditures for 4 years were $3,598, or about $300 more than a married student with children paid for food alone. The largest item of living expense was recreation, which cost $900 (25 percent) while his out-of-pocket expense for food and lodging combined was $960 (27 percent). He devoted a larger share of his budget to personal maintenance than other students did.

Source of Student Income

The dental student drew most of the money required to finance his education from sources within his own family. He supplemented these amounts with funds from other sources—scholarships, loans, or benefits available under the GI bill. This was true of both the married and the single student, though they differed in the extent to which they utilized each source (table 2).

The married student relied more heavily on his wife's earnings than on any other type of assistance. If there were no children in the family, her earnings covered more than half of all his expenses. Most of the remainder came from his own earnings and personal savings and from sums supplied by his parents. The presence of children in the household made drastic changes in this financial pattern. His

Table 2. Distribution of average 4-year expenditures by source of funds, 1953–54

Student category	Number of students	Total	Source of funds								
			Parents	Savings	Own earnings	Wife's earnings	Veteran benefits	Scholarships	School loans	Other loans	Other
		Amount									
Married:											
With children	2,021	$14,631	$3,027	$2,551	$2,252	$3,645	$1,796	$120	$110	$705	$425
Without children	2,144	14,281	2,118	1,843	1,274	7,546	825	108	54	269	244
Single:											
Away from home	3,825	10,341	6,094	1,941	1,073	-------	295	145	64	465	264
At home	1,531	8,295	4,304	1,933	1,183	-------	201	178	25	223	248
		Percent									
Married:											
With children	2,021	100.0	20.7	17.4	15.4	24.9	12.3	0.8	0.8	4.8	2.9
Without children	2,144	100.0	14.8	12.9	8.9	52.8	5.8	.8	.4	1.9	1.7
Single:											
Away from home	3,825	100.0	58.9	18.8	10.4	-------	2.8	1.4	.6	4.5	2.6
At home	1,531	100.0	51.9	23.3	14.3	-------	2.4	2.1	.3	2.7	3.0

wife's earnings then provided only a quarter of his expenses. To make up the deficit, the student dipped deeper into his savings, and the amount he earned while attending school almost doubled. His parents increased their contribution by nearly a third, and he added to this by almost tripling the amounts he borrowed. Aid received from scholarships also increased.

Both categories of single students received most of the money which paid for their education from their parents and supplied the remainder from personal savings and earnings. Parents supplied about 59 percent of funds for the student away from home and 52 percent for the student living at home. However, since the student at home was instructed to list only his own out-of-pocket expenses, the aid this student actually received from his parents would generally be much greater than these percentages indicate.

Veterans' benefits comprised only 6 percent of total funds for all students, but they made a substantial contribution to the funds of students who received them. The average amount received from this source by different categories of students varied; for the married veteran with children the benefits covered a sixth of his total costs, and for the single veteran who lived with his parents, they covered about a seventh.

Scholarships and loans were other sources of funds which were of more importance to individual students than they appear to be when averaged for an entire category of students, and the amounts obtained from them were greater for married students with children than for any other group.

Indebtedness

In spite of the substantial financial assistance received from various sources, 57 percent of all dental students were in debt by the time they were graduated. Fourteen percent owed $6,000 or more, 23 percent owed between $2,000 and $5,999, and another 20 percent, amounts less than $2,000. The size of the indebtedness rose progressively over the 4 years in school, with the average debt per student increasing from $2,193 to $4,230 between the freshman and senior years.

Conclusion

The cost of a dental education is so high that no category of students, married or single, was able to provide as much as half of total expenses from personal savings and earnings. Most students depended upon wives or parents for the major portion of their funds, and many of them went deeply in debt. For some students, particularly for those from low income groups who could not expect substantial aid from their families, the GI bill covered a large share of the costs of education. Other equally effective programs of financial aid would obviously make available to the dental profession a reservoir of capable students at a time when there is a growing need for qualified practitioners.

It should also be emphasized that despite the changing composition of the current dental student body and the gradual withdrawal of the veteran from the campus, married students will continue to make up an important segment of future enrollments. The especial needs of these students in terms of housing and other campus accommodations should be a major factor in planning future school facilities. Provisions for adequate, low-cost housing for married students would do much to solve their particular financial problems.

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CONFERENCE REPORT

Modern Methods in Preventive Medicine

Striking evidence of the application of modern methods and viewpoints in preventive medicine appears in the three papers presented on the following pages. They were given at the third annual meeting of the American College of Preventive Medicine on November 14 and 15, 1956, held in conjunction with the 84th annual meeting of the American Public Health Association, Atlantic City, N. J.

As the scientific, sociologic, and economic horizons have widened in this country, so have public health needs and potentials. A group which can testify to this from direct experience includes physicians actively engaged in or concerned with public health at the State-community level. From such a group evolved the impetus that resulted in the founding of the American College of Preventive Medicine, a professional organization stressing scientific development and application to public health.

The American College of Preventive Medicine is a relatively new society, comprised of physicians trained and active in the fields of preventive medicine and public health. It was officially organized in April 1954. But its real beginnings lie in the early days of the Association of State and Territorial Directors of Local Health Services, which had as one of its primary objectives the organization of the American Board of Preventive Medicine. Through the conjoined efforts of this and other professional associations, this objective was accomplished in 1949.

In a short time the idea began to develop among the diplomates of the board that an organization similar to the colleges or academies composed of specialists of other disciplines should be set up. Dr. George A. Dame, then president of the Florida Academy of Preventive Medicine as well as of the Association of State and Territorial Directors of Local Health Services, took the initiative in bringing together a large group of interested diplomates to consider the question. This meeting in April 1954 resulted in the founding of the American College of Preventive Medicine. Among its objectives are:

- To maintain and advance the highest possible ideals and service standards in education, practice, and research in preventive medicine and public health.
- To encourage and aid medical colleges in establishing a systematic method of teaching preventive medicine and public health . . . .
- To encourage, promote, and support the several schools of public health in the universities.
- To stimulate development of residency training centers in preventive medicine and public health.
- To support development and strengthening of sound local health departments to serve all populations and areas in our country.
- To enhance and maintain the interest of practicing physicians in preventive medicine and public health, and to further their training in these specialties.
- To promote the positive health of the individual and of the community.

The college works closely with the American Board of Preventive Medicine in developing and approving residency training programs and is active in improving intraining opportunities for public health personnel and in many other areas of its specialty. It has moved ahead rapidly along the lines of its objectives, and membership early in 1957 totaled 783 fellows. Each member is required to be a diplomate of the American Board of Preventive Medicine.

American College of Preventive Medicine

Chemotherapy of Tuberculosis, Progress and Promise

THE DECLINE in tuberculosis mortality in the United States, which began in 1910, has been sharply accelerated during the past 10 years. Tuberculosis deaths dropped from 40 per 100,000 in 1945 to about 10 in 1955. Although this drop may be due in part to a slight decrease in new cases and perhaps in some measure to earlier detection of the disease, it must be primarily a result of improved treatment. Without question, the greatest single factor in the improvement of treatment has been the development of antimicrobial agents active against the tubercle bacillus.

Adequate assessment of the new drugs required new methods in clinical research. Aside from the knowledge about what could be expected of various antimicrobial agents, the most significant result of the evaluation of tuberculosis chemotherapy was the evolution of the large-scale, centrally coordinated, cooperative control study. The pattern developed for this type of study has elements necessary for evaluation of any treatment, in tuberculosis or in other diseases. A review of the therapy trials of the Public Health Service will not only summarize the present position of the chemotherapy of tuberculosis but will illustrate the scope and possibilities of such studies.

The Public Health Service first became engaged in evaluating tuberculosis treatment in 1947, when it acted as the central office for a control study of streptomycin. Congress had made special funds available for testing this antibiotic, the first to show marked antituberculous activity in the test tube and in animals. To avoid possible repetition of the disappointment and disillusionment that followed the high hopes raised by previous "wonder" treatments, such as gold, it was necessary to test streptomycin in such a way that the great desire to find an effective drug would not influence the appraisal of its efficacy. Therefore, it was decided that the available funds should be spent largely on control studies carried out in a number of hospitals throughout the country.

To date, the Public Health Service cooperative group has undertaken nine studies on tuberculosis therapy. Tuberculosis clinicians in hospitals in all parts of the country have voluntarily pooled their facilities and case material to carry out carefully designed control studies. This cooperative arrangement provides wide geographic representation, which gives a picture of variations in the disease and its response to treatment in different parts of the country. The Public Health Service has organized the studies, provided detailed protocols, assigned treatment regimens, coordinated the work in the participating hospitals, analyzed the data, and provided financial assistance to the hospitals to meet the special study expenses.

Each clinician relinquishes some autonomy in treating patients he places in a study. But he is aware of the exact limits of the restrictions because he himself has helped to plan the study. Knowing that any patient placed in the study may by chance receive any one of the regimens to be investigated, the clinician

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This paper was presented before the American College of Preventive Medicine by Dr. Rufus Payne, Medical College of Georgia, Augusta, one of the clinical investigators in the Public Health Service tuberculosis therapy trials. It was prepared by Shirley H. Ferebee and Dr. Frank W. Mount, Tuberculosis Program, Division of Special Health Services, Public Health Service.

selects only those patients for whom he feels he can ethically accept the alternatives. Once he has decided to include a patient, treatment is assigned in the central office by a system of random numbers, and the patient is treated with the assigned medication for a specified period. This is a critical point in the studies: a system in which treatment is assigned by persons who have no knowledge of the patient. It eliminates any influence, conscious or unconscious, which physicians treating the patient might exert on the assignment of treatment regimens. Not only is this method simpler for the physician responsible for the care of the patient but it is also the only sure way of obtaining groups of patients that are alike at the moment the different chemotherapeutic regimens are started. Thus, any subsequent differences between the groups can be attributed to the effects of chemotherapy.

Only in two exceptional circumstances is treatment altered: if a patient develops an intolerance to one or more of the assigned drugs or if his disease becomes critically worse, threatening his life.

The number of patients in a study ranges from 541 in the first cooperative effort, with 12 participating hospitals, to 1,990 in one of the more recent trials, with 29 hospitals. The size of these studies insures that the results are unlikely to be due to chance variation. In addition, it permits examination of the influence of various factors, such as age, race, and sex of the patient and stage and extent of disease, on the response to treatment.

In this era of bigness the impression is sometimes created that numbers alone are enough. But a definitive study depends only partly on size. These studies have also been carefully designed with these points in mind: What are the critical questions? What observations will provide the most information? How can these observations be made most objective and accurate?

Random allocation of treatment provides treatment groups completely comparable at the beginning of a study. By several other devices we try to obtain objectivity and freedom from bias in measuring the effects of treatment.

In testing for bacterial resistance, for example, sputum cultures are first examined in each hospital laboratory by technicians who are not allowed to know the patient's treatment. All positive cultures from all hospitals are sent to one central laboratory not associated with any of the hospitals. There each culture is tested for drug sensitivity without the bacteriologist's knowing the patient's regimen. In every study, many cultures are tested for sensitivity to drugs that the patient is not even receiving. The results of these cultures provide valuable information on the validity of the other results.

In the interpretation of X-rays, as another example, duplicate X-rays of each patient are taken monthly. One is kept at the hospital and one is sent to the central office. Periodically, the participating clinicians meet in Washington to review all the films. The serial films for each patient are read independently by three readers who do not know the patient or his treatment regimen. Each reader interprets the films for an equal number of patients on each regimen from every hospital except his own.

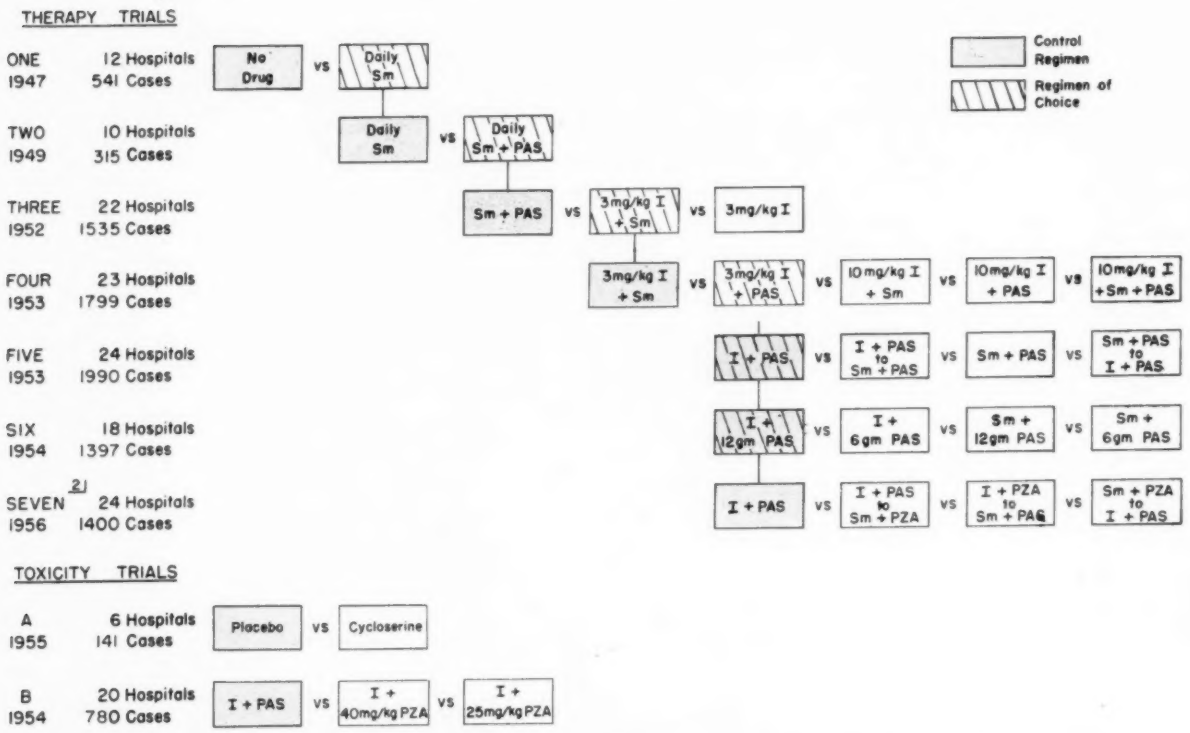
We shall now review briefly the nine cooperative studies carried out since 1947, tracing the evolution of tuberculosis chemotherapy and highlighting the results of the studies. In each subsequent study, new regimens are tested against the regimen which has previously given the best results. A summary of the studies is presented in figure 1.

Streptomycin and PAS

In the first study streptomycin was tested against no chemotherapy. A randomly selected half of the 541 patients received the classic treatment of bed rest, diet, and surgery, while their counterparts in each hospital received, in addition, streptomycin for the first 3 months of a 12-month observation period. Physicians in the 12 hospitals participating in this investigation deserve credit for their courage in carrying through a study in which streptomycin was withheld from half their patients.

By every criterion, patients who received streptomycin for 3 months were in better condition after 12 months than were the controls. Seventy percent of the streptomycin patients showed X-ray improvement, as compared with only 45 percent of the controls. Cultures were

Figure 1. Summary of the Public Health Service tuberculosis therapy trials.[1]



[1] Unless otherwise specified, Sm (streptomycin) was given in doses of 1 gm. 3 times a week; I (isoniazid), 3 to 5 mg./kg. daily; PAS (para-aminosalicylic acid), 12 gm. daily; and PZA (pyrazinamide), 40 mg./kg. daily. Cycloserine was tested in four dosages: 0.5 gm. twice a day, 1.0 gm. every second day, 0.5 gm. once a day, and 0.25 gm. twice a day.

[2] In progress.

negative for 24 percent of the streptomycin patients but for only 16 percent of the controls. The most striking finding in this first study, however, was that streptomycin halved the number of deaths: Only 10 percent of the streptomycin patients, as compared with 20 percent of the controls, died during the year of observation.

Shortly after streptomycin was introduced, PAS (para-aminosalicylic acid) became available in this country. With the usefulness of streptomycin clearly evident, the cooperating group decided its second study should compare streptomycin alone with streptomycin plus PAS. Since PAS showed much less tuberculostatic activity than streptomycin in the test tube and experimental animals, it was not thought necessary to include a group receiving only this drug. Each of 315 patients was randomly assigned to receive either streptomycin or streptomycin plus PAS for 3 months, with observation to continue for another 3 months. The primary purpose was to see whether PAS might prolong the usefulness of streptomycin by delaying the emergence of streptomycin-resistant organisms. It was found that not only did PAS prolong the streptomycin sensitivity of the tubercle bacilli, but it increased the frequency of sputum conversion and resulted in greater X-ray improvement.

By 1952 the price of a gram of streptomycin had fallen from $20 to about 20 cents, and the drug was available in plentiful supply, as was PAS. The two drugs together had become the standard treatment for hospitalized tuberculosis patients throughout the United States. They were indispensable adjuncts to bed rest and surgery in the long-term care necessary for tuberculosis patients. Then in March 1952 isoniazid made its dramatic entrance. In the midst of tremendous enthusiasm for the new drug, the Public Health Service took the posi-

tion that isoniazid must be compared in strict control studies with the best therapy then available, that is, streptomycin plus PAS. Consequently, in that same month, representatives of 22 tuberculosis hospitals met in Washington and adopted a common protocol to evaluate the therapeutic efficacy of isoniazid. Within 5 months 1,535 patients were under observation.

In the course of these investigations, bacteriological change had emerged as the most sensitive index of the effectiveness of antimicrobial agents. In the charts to follow, bacteriological results of various regimens are compared for previously untreated patients who were infectious when they were admitted to the studies.

Isoniazid

Since the second study had shown streptomycin plus PAS to be superior to streptomycin alone, we used streptomycin plus PAS in the third study as the yardstick against which to measure isoniazid alone and isoniazid in combination with streptomycin. For all regimens the decrease in positive cultures was rapid during the early weeks of treatment. By the 40th week, however, cultures were still positive for 39 percent of the patients treated with streptomycin plus PAS and 38 percent with isoniazid alone, but for only 25 percent with isoniazid plus streptomycin (fig. 2).

Having found isoniazid plus streptomycin superior to either streptomycin plus PAS or isoniazid alone, we proceeded to a fourth study, which included 1,799 patients. We used isoniazid plus streptomycin as the basic regimen and compared it with isoniazid plus PAS and with all three drugs together, isoniazid plus streptomycin plus PAS. We also investigated the possibility that better results might be obtained by increasing the daily dose of isoniazid from 3 mg./kg. to 10 mg./kg.

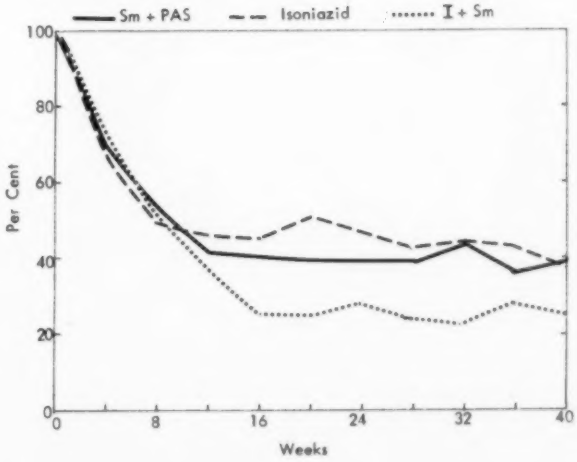
The three regimens with 10 mg./kg. of isoniazid were about equally effective in reversing infectiousness (fig. 3). At the end of 40 weeks of treatment, tubercle bacilli were detected in the cultures of 17 percent of the patients treated with isoniazid plus streptomycin, in 8 percent treated with isoniazid plus PAS, and in 6 percent treated with all three drugs. Although there was no therapeutic advantage when the dose of isoniazid was raised from 3 to 10 mg./kg., the 10 mg./kg. dose was considerably more toxic, producing peripheral neuritis in about 10 percent of the patients. On the basis of these findings, we reasoned that the regimen of choice at that point was isoniazid at 3 mg./kg. plus PAS, which would leave streptomycin to be used later if necessary.

Switching Regimens

In all these studies bacteriological changes were rapid during the early weeks of treatment, but patients still producing positive sputum after the 20th to 24th week seldom became negative. This observation led to the fifth study, in which major drugs were switched after 24 weeks of treatment and different sequences tried. For the first 24 weeks we gave half the patients isoniazid plus PAS and half streptomycin plus PAS. Then we switched half the patients receiving isoniazid plus PAS to streptomycin plus PAS and half those receiving streptomycin plus PAS to isoniazid plus PAS.

During the first 24 weeks, when half the 1,990 patients were receiving isoniazid plus PAS and half streptomycin plus PAS, the decrease in positive cultures was greater with isoniazid plus PAS (fig. 4). By the 24th week cultures

Figure 2. Percentage of patients with positive cultures during 40 weeks of treatment with streptomycin plus PAS, isoniazid, or isoniazid plus streptomycin.



had become negative for all but 26 percent of the patients on streptomycin plus PAS and for all but 8 percent of the patients on isoniazid plus PAS. Patients whose cultures had not become negative may be regarded as treatment failures, and their course during the subsequent 24 weeks is reported here.

The treatment failures included patients who died of tuberculosis or whose chemotherapy was changed because of critical worsening, as well as those who continued to produce tubercle bacilli after 24 weeks on the primary regimen. Of course, for those who died there was no opportunity for the secondary regimen to change the course of their disease, and for those whose treatment was changed earlier the status at the 24th week is not a measure of the effect of 24 weeks of treatment on the assigned regimen.

The left chart in figure 5 deals with the 26 percent of the streptomycin-plus-PAS patients who had failed to become sputum negative, including 4 percent who had died or been removed from the regimen. When treatment with streptomycin plus PAS was continued, the failure group decreased to 20 percent by the 40th week. However, when isoniazid plus PAS was substituted for streptomycin plus PAS, the proportion of bacteriological failures dropped to 10 percent by the 40th week.

Figure 3. Percentage of patients with positive cultures during 40 weeks of treatment with isoniazid plus streptomycin, isoniazid plus PAS, or isoniazid plus streptomycin plus PAS.

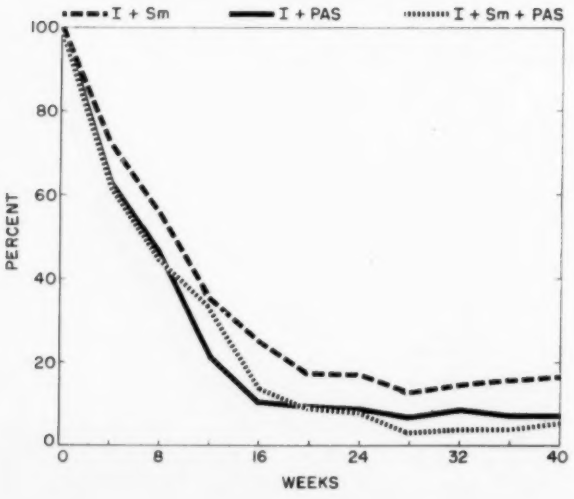
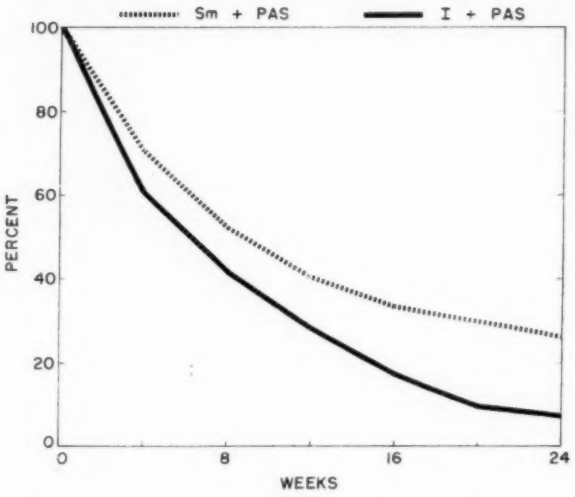


Figure 4. Percentage of patients with positive cultures during 24 weeks of treatment with streptomycin plus PAS or isoniazid plus PAS.



The right chart in figure 5 deals with the 8 percent of the isoniazid-plus-PAS patients whose cultures had not become negative by the 24th week. This group includes 1 percent who had died or had been changed to another treatment regimen. When treatment with isoniazid plus PAS was continued, the percentage of failures dropped to 4 by the 40th week. When treatment was switched to streptomycin plus PAS, the results were no better.

This study showed isoniazid plus PAS to be such an effective regimen that there was little advantage in switching to streptomycin plus PAS after 24 weeks. On the other hand, among patients initially treated with streptomycin plus PAS, a switch to isoniazid plus PAS after 24 weeks was preferable to an additional 16 weeks of streptomycin plus PAS.

Decreased PAS Dosage

Again isoniazid plus PAS appeared to be the regimen of choice both for initial and long-term use. However, it had always had one disadvantage. A number of patients were unable to tolerate the usual large dose of PAS, 12 grams a day. Encouraged by the results of a small pilot study, we decided to see whether decreasing the dose of PAS would reduce toxicity without loss of therapeutic effect. Although we were primarily interested in the use

of PAS with isoniazid, we also used this opportunity to test a lower dose of PAS with streptomycin. We randomly divided the 1,397 patients into 4 groups to receive daily isoniazid with 12 grams of PAS, isoniazid with 6 grams of PAS, streptomycin with 12 grams of PAS, and streptomycin with 6 grams of PAS.

This study demonstrated that PAS toxicity was reduced by decreasing the daily dose. During the 40 weeks of treatment about 11 percent of the patients could not tolerate the 12 gram dose, but only 4 percent could not tolerate 6 grams. Most of the patients who could not tolerate the larger dose were able to continue the drug when the dosage was cut in half.

In combination with either isoniazid or streptomycin the large dose of PAS was slightly more effective than the small dose (fig. 6). Again, the combination of isoniazid plus PAS was superior to streptomycin plus PAS. In fact, even the small dose of PAS with isoniazid was more effective than the large dose with streptomycin.

We concluded that all patients should be placed first on a regimen of isoniazid plus 12 grams of PAS. However, for those unable to tolerate that dose of PAS, the daily dose could be reduced to 6 grams with only a small loss in therapeutic effectiveness.

Figure 5. Percentage of patients with positive cultures from the 24th through the 40th week among patients treated continuously with streptomycin plus PAS or switched from streptomycin plus PAS to isoniazid plus PAS after 24 weeks and among patients treated continuously with isoniazid plus PAS or switched to streptomycin plus PAS after 24 weeks.

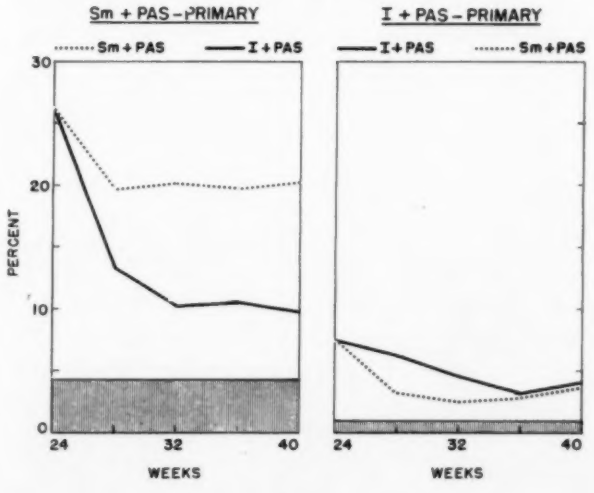
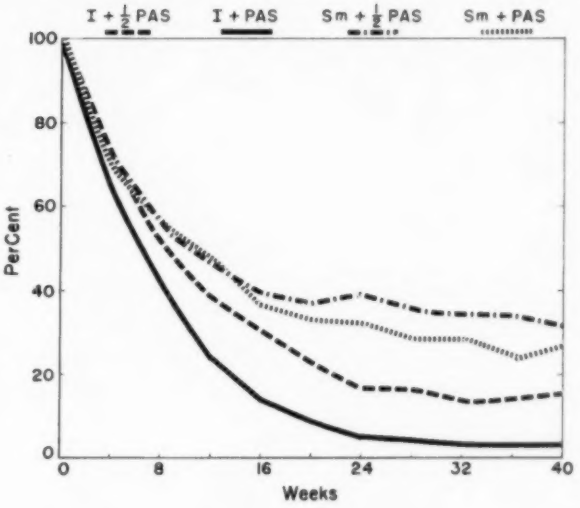


Figure 6. Percentage of patients with positive cultures during 40 weeks of treatment with isoniazid plus 6 gm. PAS, isoniazid plus 12 gm. PAS, streptomycin plus 6 gm. PAS, or streptomycin plus 12 gm. PAS.



Cycloserine and Pyrazinamide

Up to this point, we had been investigating ways of using the three available drugs, isoniazid, streptomycin, and PAS. In the past 2 years we have considered, in addition, two other antimicrobial agents, cycloserine and pyrazinamide. Both drugs had been reported to produce severe toxic reactions. Therefore, before testing their therapeutic efficacy in previously untreated patients, we undertook studies among "hopeless cases" to determine the frequency and severity of the toxic reactions.

In one toxicity study we compared several different doses of cycloserine with a placebo. No significant toxic reactions occurred among the 26 patients receiving placebos, but toxic reactions to cycloserine occurred at all dose levels tested except the lowest, which we found to be below the range of therapeutic effectiveness (see table). Convulsions, the most serious of the toxic effects, were not confined to a single dosage, and we found no evidence that they were limited to patients with certain characteristics. Therefore, in contrast with the safety and effectiveness of isoniazid

Toxic reactions of patients unable to tolerate assigned cycloserine regimens

Cycloserine regimen	Number patients treated	Number with toxic reactions[1]	Number with convulsions
Total	115	18	8
0.5 gm. twice daily	25	11	4
1.0 gm. every second day	39	5	3
0.5 gm. once daily	38	2	1
0.25 gm. twice daily	13	0	0

[1] Includes convulsions.

plus PAS, we concluded that cycloserine was too toxic for us to undertake a large-scale therapeutic trial in patients with a favorable prognosis.

Pyrazinamide had been reported to have a dramatic therapeutic effect when used with isoniazid but to cause acute liver damage in some patients. In a carefully controlled study among 780 treatment failures, we used isoniazid plus PAS as a control and tested 2 doses of pyrazinamide in combination with isoniazid. Liver function tests were carried out in the hospital laboratories by technicians who did not know what drugs the patients were receiving, and the patients were examined for signs and symptoms of hepatitis by physicians who had no knowledge of their treatment.

During the first 12 weeks of treatment, evidence of hepatic toxicity was reported for 0.8 percent of the patients receiving isoniazid plus PAS and for 0.8 and 1.2 percent of the patients receiving, respectively, 40 mg./kg. and 24 mg./kg. of pyrazinamide with isoniazid. During the second 12-week period liver damage appeared among 5.4 percent of those receiving the larger dose of pyrazinamide and among 1.2 percent of those receiving the smaller dose. These findings, plus the fact that the treatment failures had shown considerable therapeutic benefit from the combination of isoniazid and pyrazinamide, made us decide to undertake a large-scale therapeutic trial of pyrazinamide in combination with isoniazid and in combination with streptomycin. However, we are using pyrazinamide for only 16 weeks and are then switching regimens. This study was begun only recently, and it will be some months before results will be available.

Prophylactic Possibilities

For those of us concerned with preventive medicine, interest in the treatment of persons with active pulmonary tuberculosis is not confined to the direct benefits to the patients. We are sensitive to an indirect benefit from improved treatment: the decrease in spread of disease. More infectious persons are willing to accept treatment, and infectiousness is reversed in most of those treated.

Now, isoniazid introduces the possibility of a new method of tuberculosis control: prophylaxis. It is a cheap, orally administered drug that has been demonstrated during the past 4 years to be extremely effective in the treatment of patients with tuberculosis and to be practically nontoxic in therapeutic doses. A drug that can reverse the course of far-advanced cavitary disease might, if given at the right time, prevent the appearance of clinical disease.

Prophylaxis in tuberculosis has become a highly controversial subject. Some enthusiasts advocate immediate widespread use of the drug in highly exposed population groups. Others are equally firm in their conviction that such use of isoniazid would have grave consequences by interfering with the development of natural immunity. But there is also a middle ground, one occupied by many physicians and public health workers. They feel, as does the Public Health Service, that only a series of large, long-term, controlled investigations can provide actual data to replace the present spate of conjecture on the effects of using isoniazid to prevent clinical tuberculosis in human beings.

The Public Health Service and a number of cooperating clinicians and public health workers have begun a series of studies on the prophylactic possibilities of isoniazid. In the first study in human beings, the prophylactic goal is the prevention of meningitis and other complications among children with asymptomatic primary tuberculosis whose present condition does not require treatment. More than 2,000 children are now under observation in 31 pediatric clinics in the continental United

States, San Juan, Mexico City, and Toronto. Each child takes pills for 1 year, and neither the patient, nor his family, nor the physician knows whether the pills contain isoniazid or placebo. By comparing the number, kind, and severity of complications that develop among children taking isoniazid with the complications that develop among children taking placebos, we expect to determine isoniazid's effectiveness.

In the meantime we are accumulating information to answer an even more basic question: How often today do meningitis and other complications of primary tuberculosis occur? In other words, we are collecting precise information on how much there is to prevent, by isoniazid or any other preventive procedure.

The next step in the Public Health Service's investigation is to determine whether isoniazid will prevent infection and the appearance of clinical disease among the highly exposed household contacts of active cases of tuberculosis. A nationwide study is being started in which contact households are randomly assigned to isoniazid or placebo groups and are kept under close observation by their local health departments. Each contact is tuberculin tested and X-rayed at the beginning and at

Clinical Investigators in the Tuberculosis Therapy Trials

The following 53 physicians in 39 hospitals scattered throughout the United States participated in the Public Health Service tuberculosis therapy and toxicity trials conducted from 1947 through 1956. The figures and letters in parentheses are trial designations, as given in figure 1.

Baltimore City Hospital, Baltimore, Md.: Edmund G. Beacham (7).

Battey State Hospital, Rome, Ga.: Rufus Payne (2,3,4) and Raymond Corpe (4,5,6,7,B).

Benjamin Franklin Hospital, Columbus, Ohio: Harold Humphrey (5, 6,7).

Cedarcrest Hospital, Newington, Conn.: R. C. Edson (5,6,7,B).

Channing Home for Tuberculosis, Boston, Mass.: Theodore L. Badger (2).

Firland Sanatorium, Seattle, Wash.: Roberts Davies (3,4,B), Daniel Zahn (6,A), and Thomas Sheehy (7).

Florida State sanatoriums in Lantana, Orlando, and Tampa: Roberts Davies (6,7), W. L. Potts (3,4, 5,B), George H. Hames (6,7), Benjamin L. Brock (3,4,5,6,7,B), Henry C. Sweany (3,4,5,B), A. M. Dietrich (4), and Frank Cline (7).

Freedmen's Hospital, Washington, D. C.: Howard M. Payne (1,2,3,4,5, 6).

Glen Lake Sanatorium, Oak Terrace, Minn.: Sumner S. Cohen (3,4, 5,6,7,A,B).

Herman Kiefer Hospital, Detroit, Mich.: Paul T. Chapman (3,4,5,6,7, A,B).

Maybury Sanatorium, Northville, Mich.: W. J. Steininger (3,4,5,6,7, A,B).

Middlesex County Sanatorium, Waltham, Mass.: Francis P. Dawson (2,3).

Missouri State Sanatorium, Mount Vernon, Mo.: Charles A. Brasher (4, 5,6,7,B).

Municipal Tuberculosis Sanitarium, Chicago, Ill.: LeRoy H. Berard (5,7).

New York State hospitals: H. McLeod Riggins (1,2); Hermann M. Biggs Memorial Hospital, Ithaca: N. Stanley Lincoln (1,2); Homer Folks Tuberculosis Hospital, Oneonta: Ralph Horton (1,2); Mount Morris Tuberculosis Hospital, Mount Morris: Arthur M. Stokes (1,2); Ray Brook Sanatorium, Ray Brook: Harry A. Bray (1) and Frederick Beck (2).

North Carolina State sanatoriums in Black Mountain, McCain, and Wilson: Charles D. Thomas (1,3,4,5,6, 7,B), H. Stuart Willis (1,2,3,4,5,B), W. H. Gentry (3,4,5,B), and Herman F. Easom (1,3,4,B).

Olive View Sanatorium, Olive View, Calif.: Emil Bogen (1).

Ohio Tuberculosis Hospital, Columbus, Ohio: R. H. Browning (7).

Pennsylvania State sanatoriums in Cresson, Hamburg, Philadelphia, and South Mountain: J. L. Wilson (3,4,5), H. W. Weest (3,4), Frederick R. Lang (B), G. M. Eckley (3,4,5,7,B), and H. C. Dooling (3, 4,5).

Pittsburgh Tuberculosis Hospital, Pittsburgh, Pa.: George E. Martin (3,4,5,6,7,B).

Robert Koch Hospital, Koch, Mo.: Alfred Goldman (1,2,3,4,5,7,B) and Mario Pianetto (3,4,5,7,B).

San Antonio State Tuberculosis Hospital, San Antonio, Tex.: E. H. Gist (5,B) and E. H. Roberts (6,7).

Seward Sanatorium, Seward, Alaska: Lawrence M. Lowell (1).

Stanford University Hospital, San Francisco, Calif.: William M. M. Kirby (1).

Sunny Acres Tuberculosis Hospital, Cleveland, Ohio: Harold G. Curtis (3,4,5,6,7,B).

Tennessee State Tuberculosis sanatoriums in Memphis and Oakville: E. P. Bowerman (3,4,5,6,7,A,B) and F. H. Alley (3,4,5,6,7,A,B).

Uncas-on-Thames Sanatorium, Norwich, Conn.: George C. Wilson (3,4,5,7,B).

U. S. Public Health Service Hospital, Brooklyn, N. Y.: Raymond Hofstra (3), J. E. Wilson (4,5), and Erwin Blatter (6,7).

the end of a year of prophylaxis. Included in the study population are both uninfected (tuberculin negative) members of the household and infected (tuberculin positive) members who show no clinical evidence of disease. The study should provide information on the effectiveness of isoniazid in preventing new infections and in preventing development of clinical disease in those already infected. Because this study includes a group that gets only placebos, it will also provide information on just how much tuberculosis is arising today among household contacts of the tuberculous.

In still another branch of this investigation, isoniazid's effect among previously infected persons who are not in highly exposed situations will be studied. An impressive body of evidence is accumulating that much of the new clinical tuberculosis is occurring among previously infected persons whose subclinical infection progresses to active disease under either external stress or decreased general resistance. It seems most important to determine whether the threat of tuberculosis which millions of older persons infected in childhood carry with them can be removed by prophylactic use of isoniazid.

This difficult and costly investigation may show that isoniazid has no prophylactic value, or that its value is offset by interference with natural immunity, or that it is effective only while it is being taken. It may show that it only delays but does not prevent. On the other hand, if it is effective in any one of the areas under investigation, in preventing infection, in preventing new infection from progressing to clinical disease, or in eradicating old subclinical infections which may flare up in endogenous disease, we will have gained an important public health weapon in the fight against tuberculosis.

Cerebral Vascular Disease Program

The first nationwide cooperative research program on cerebral vascular disease was launched in April 1957.

Ten medical research centers in 9 States have joined in the program, and it is expected that 35 to 40 institutions will eventually participate. The program, which is under the auspices of the National Institute of Neurological Diseases and Blindness of the Public Health Service, was made possible by grants from the National Institutes of Health to the various participating organizations. The program is supplemented by 29 current research projects on various aspects of cerebral vascular disease.

Cooperative investigation will make possible the study of thousands of patients who either have suffered a stroke or who show clinical signs indicating that a stroke might be approaching. The program is specifically concerned with patients suffering from cerebral vascular disease involving hemorrhage, blood clots, blood tumors, (aneurysms), and malformations of the arteries or veins of the brain.

Research results may reveal more about the nature and causes of strokes and facilitate more effective treatment methods.

Data collected will be collated and evaluated at the University of Iowa, Iowa City, one of the cooperating institutions.

Public Health and the Social Sciences

By HENRY VAN ZILE HYDE, M.D.

PUBLIC health physicians and their professional colleagues have an implied responsibility for assisting peoples of the world to improve the shape of their affairs. Let us consider what the world role of public health may be and how the social sciences may be of use in playing it.

The social sciences occupy a strange place in the world of learning. They are not quite accepted in the parlor, but it is being increasingly recognized that they are cooking something promising in the kitchen. James B. Conant, struggling in his Terry lectures with the question of the place of the social sciences on today's scene, concludes that perhaps the social scientist should be considered a social philosopher and points out what a sterling word "philosopher" really is. Alfred North Whitehead, considering the place of science in the modern world, finds a tendency for the natural sciences to fall into grooves and to miss the necessary comprehension of man's life among men. Despite the great accomplishments of the natural sciences, we have, he says, no expansion of wisdom, when we are in greater need of it than ever before.

Do the social sciences, as a philosophy in the original Greek sense, perhaps fit into the niche that is vacant? Do they, in dealing with the problems of man's relation to man, somehow provide, or at least promise, a bridge between the coldness of the test tube and the warmth of human feelings?

The social sciences consist only of attempts to apply known techniques of observation, experimentation, and logic to man's total behavior as a rational and emotional animal, and to the groups through which he acts and relates himself to others. They are attempts to look at human feelings through the test tube.

Again, as in the case of the natural sciences, grooves form: psychology, social psychology, sociology, economics, anthropology, and so on. Knowledge today is so vast that it must be organized. It is necessary to make certain that such organization does not create intellectual iron curtains. Rather, it must create bridges between areas of thought and knowledge.

Science proceeds by the formulation and testing of concepts, amending, enlarging, and replacing them as fact and experience, seen through the glass of wisdom, may dictate. The social sciences may, because of the material with which they deal, be expected to develop broadening concepts dealing with man's relations with man, concepts which when institutionalized may lead to a richer life. The United Nations did not arise full-formed, Venus-like from the sea, but is the institutionalization of concepts that have developed and progressed through the centuries. Thucydides, in fact, set the philosophical and political stage for the United Nations when he said that discussion does not block action but is the only precursor to action that wisdom can allow.

On the basis of what we have seen of the social sciences to date, should we be frustrated and throw up our hands in despair? Raymond Fosdick, in his thoughtful treatment of the social sciences in the Story of the Rockefeller Foundation, says that "unless we find successful solutions to some of the intricately complex and fast-growing problems of human relationship, we run the risk of having a world in which public health and medicine are of little signifi-

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cance." He further cautions against impatience in this difficult task, saying, "The impatient analogy between the spectacular progress of public health and medicine and what could conceivably be accomplished by the social sciences is basically unsound. Human emotions and prejudices, unlike human diseases, do not yield easily to rational solutions. We can look forward to no mechanistic answers which will automatically solve the problems of human adjustment. The assumption has to be made that there is time for intelligence to take hold, and students of society have to presuppose the opportunity for long-maturing work." The Rockefeller Foundation and more lately the Ford Foundation are betting hundreds of millions of dollars on this assumption.

The Relation to Public Health

How does this relate to public health? to members of the profession?

Public health is in a unique position in relation to man and his communities. It is also an activist cult, the self-imposed business of which is to change man's behavior. Because of its opportunity and its activities, public health has an obligation to study, within its own field of vision, the processes that affect man's behavior. We are the high priests of an activist cult. We must accept the responsibilities of priesthood, unless we are to become practitioners of a stultified priestcraft such as served their own purposes under the protecting wings of Amen-Ra in far-off times. We must learn not only how, but whether and when to activate. The social sciences offer the best available avenue for the exploration of the city of fact and relationship in which each of us lives—to obtain a better comprehension of the community of man and how best to modify it in the interests of man.

The trouble of our times, great in scope and profound, is based on man's failure in governing his relationship to himself. The connection with public health may appear at first glance to be loose and remote. Such is not the case: Health today is not on the periphery of history but at or very near its center. In the most populous areas of the world where the masses are sick, it is one of the major factors affecting man's relationship to himself and to his environment.

One phase of the role of public health in the world today is its modification of man's relationship to himself and to his environment. This modification initiates chain reactions in the social and economic spheres, the end of which is not always, if ever, in sight. Public health has, for instance, launched a vast malaria eradication program, with a view to eliminating the 300 million cases of malaria that once occurred each year. A number of countries, including our own, have already attained the objective of eradication, and the world goal is not an impossible one. Can we foresee the ultimate effects on mankind of such a change? We know it will have effects on man's ability to produce. It will provide increased labor in the fields during planting and harvesting time; it will open up new lands; it will make man more alert and educable. Yes, and it will increase the population where populations are already dense. These changes will in turn have their own effects, and these can be foreseen but dimly.

The world can never again be what it once was. Asia, particularly the areas in the tropics and semitropics and the Middle East, and Latin America are not the same as they were even a short time ago. Their relationships with other more advanced parts of the world in northern Europe and North America are changing, and will change, deeply and fundamentally. Health has a causal relationship to this great historical change. This we cannot avoid, but we can try to understand it and to lead it in a direction that is right by our moral view.

The second phase of the role of public health stems from its peculiarly close association with man and the community. Here is the opportunity for public health to add to the understanding of the human processes that make history. Historic events are due to the working in the macrocosm, the world, of forces that are also at work in the microcosm of our own communities. These forces can be isolated, analyzed, and understood with more precision in the microcosm. On the larger stage they are often lost in the very vastness of the scene.

Understanding the Individual

What are these forces that we need to understand? One is the behavior of individuals in settings of various complexities. What are the forces that influence the individual? This may not seem relevant when we are considering the world stage, but it is. The world is run by human beings, each an individual shaped by a multitude of antecedent forces. Often the individual is lost in the vastness of the action that he has taken or influenced, but all world actions are the result of the component forces at work on the world stage, and those forces are transmitted through individuals and modified by transmission. Personal pique and animosity, emotional reactions, individual blind spots play their role internationally as they do at home, affecting the course of history.

At Versailles, after World War I, Masaryk, the father of Czechoslovakia, was one of the great leaders. He was known for his wisdom, his ideals, and thus was able to give leadership and direction to the shaping of the new Europe. Only on one point did he become irrational and obstructive. He insisted upon the inclusion within Czechoslovakia of a small nipple of land that projected beyond the proposed borders of Czechoslovakia into what was logically a part of Poland. Why did he do this? Because his birthplace, his hometown, lay within that area. Thus it is men who make the events of history and men that need to be understood. Public health deals with men and has a chance, perhaps, to understand men and thus to enable them to understand themselves.

The problems of the community tend to stand out in progressively bolder relief the farther we move from our own culture, setting aside, as we do, the blinders of our own experience and our own emotional involvements. For this reason and because of my particular international orientation, I take an example from abroad, in the expectation that we may see analogies in our own communities, to indicate the complex skein of forces that interweave within a community.

Sindbis is a crowded, squalid Egyptian village. The streets are narrow, muddy, and laden with refuse. The Rockefeller Foundation addressed itself to the problem of improving health in this village and worked there for 3 years. It was easily demonstrated that infant mortality and therefore general mortality could be sharply reduced by the application of insecticides to control the flies. This, though, was a temporary measure, the flies becoming rapidly resistant to the insecticides. The demonstration pointed to the absolute necessity of improving sanitation if anything significant were to be accomplished.

An Egyptian home is a mud-walled compound off of which open 2 or 3 small, unventilated rooms; a rickety stairway goes up to similar small rooms above. In crowded villages such as Sindbis, the compound is often roofed-over by the upper rooms. In the compound, which measures perhaps 10 by 10 feet, there dwell, in addition to the family, a gamoose (a water buffalo), a sheep or two, and several chickens. These are occupying what to you and me is the living room. In the corner is a pile of dung cakes. The floor is carpeted by the accumulated dung of decades. Meals are cooked over an open fire in a corner of the compound. It would appear that health education in its simplest forms might readily solve such obvious problems. But let's look at some of the factors concerned.

Sindbis is built upon some of the most precious land in the world. In Egypt, on 13,000 square miles of arable land, 23,000,000 people, 1,800 people per arable square mile, are attempting to eke out an existence. It is not possible for Sindbis to expand laterally over such precious land, nor, since the only available building material is mud or sun-dried brick, can it extend vertically. A second story is risky; a third story, impossible. On May 12 and 13, 1945, rain in parts of the Delta, the only rain I ever saw in Egypt, washed away such villages as this.

If we cannot provide better housing within the locally available resources, then we can at least clean out the dung. But this approach also presents problems. The dung is one of the family's most important assets, both for fertilizer and for fuel. It cannot be risked outside but must be kept under guard.

Then let us move the animals out. Did you ever suggest to your own family the possibility of getting rid of your own dog? The eyes of a gamoose, I can testify, are infinitely more

soulful than even those of a basset hound. There is a deep emotional, as well as economic, attachment to the gamoose. He is part of home and he has been so through the ages. Herodotus in 500 B. C. wrote, "All other men pass their lives separate from animals; Egyptians have animals always living with them."

Thus, in attempting to activate the people of Sindbis, we immediately run into economic considerations of the greatest moment, long-established habits and cultural patterns, and sociological problems.

Universality of the Basic Forces

The same basic forces operate in every community. We would not have a gamoose in our homes, but we do have dogs. Dogs are carriers of rabies, hydatidosis, and flukes whereas, as far as I know, the gamoose is quite an innocent beast. Despite this, we cannot view a dog with the same objectivity with which we view a gamoose.

Herodotus helps us establish the fact that this blindness is not a new thing. He tells us: "Thus it appears certain to me, by a great variety of proofs, that Cambyses was raving mad; he would not else have set himself to make a mock of holy rites and long-established usages. For if one were to offer men to choose out of all the customs in the world such as seemed to them the best, they would examine the whole number, and end by preferring their own; so convinced are they that their own usages far surpass those of all others. Unless, therefore, a man was mad, it is not likely that he would make sport of such matters. That people have this feeling about their laws may be seen by very many proofs: among others, by the following. Darius, after he had got the kingdom, called into his presence certain Greeks who were at hand, and asked what he should pay them to eat the bodies of their fathers when they died. To which they answered that there was no sum that would tempt them to do such a thing. He then sent for certain Indians, of the race called Callatians, men who eat their fathers, and asked them, while the Greeks stood by, and knew by the help of an interpreter all that was said, what he should give them to burn the bodies of their fathers at their decease. The Indians exclaimed aloud, and bade him forbear such language."

We can easily overlook in our own environs what might be obvious aberrations when viewed dispassionately by an outsider, unless we apply the critical tools of science to our own behavior and that of our own communities. The answers to the problems of Sindbis are yet to be found, but we have in our own community the laboratory in which the basic principles involved may be better understood.

What are some of these matters as we face them in our own communities?

The cult of success drives us Americans inexorably towards the vice-presidency of the firm. En route we deposit in our arteries great hunks of cholesterol, consumed at feasts paid for by a grateful firm. Or we build up a great head of pressure striving to be foreman of the gang, principal of the school, or State health officer, ignoring what we know, or think we know, of the dangers to our gastric mucosa. This is cultural pressure, our own culture. Can we modify the culture or adjust man to it? Do we preach laziness and apathy? Do we give tranquilizing drugs? Or is there some other way? Daily we drive headlong to our own destruction on the highways. You know this grim story, but who of us has never bragged of the speed he made on some trip? Our culture commends us, if only we keep out of jail. Coronary disease is not all chemistry, and highway safety is not all engineering. They involve man and his behavior in a cultural setting.

The problems of convincing communities to fluoridate water, or parents to bring only certain of their children for a widely touted vaccine, or a woman to palpate her breasts when horror struck that she might feel a fatal lump are examples of problems here at home that have in them, somewhere, answers to fundamental problems of men's relations and motivations.

I have been deeply impressed through the years with the sameness of motivations and responses among people of widely differing cultures. The differences to a large extent are superficial. Being exotic, they tend to impress us overmuch. Members of this college deal almost daily with colleagues from other lands. I trust you find a deep sameness in them. If

this be the case, it is possible to understand the points of difference and to prepare to meet and reconcile them.

Profound problems arise, problems we can only suggest in this presentation. For example, is action always to be preferred over apathy? F. S. C. Northrop of Yale, Edmund Taylor in his Richer by Asia, and many others have considered how we might attain some profitable fusion of the philosophies of the East with those more characteristic of the West, a reverse point 4 in philosophy perhaps. They suggest that a more intensive search for karma or nirvana might modify the intensity of the search for space and substance, for land and dollars. Such questions have their social and economic implications which are subject to analysis and indeed measurement in economics, which is perhaps the most adult of the social sciences.

If we accept a wholly activist philosophy, then action must be purposeful and the purpose, as well as the results of attainment of the purpose, must be examined. Purposes often seem self-evident. We accept the urgent need for rapid economic development as a truism. But Munoz-Marin, the Governor of Puerto Rico, who has given such magnificent leadership to Operation Bootstrap which has raised Puerto Rico from a slum to a guiding star of progress, has recently offered a tantalizing suggestion. He has proposed an Operation Serenity, through which society "would use its economic power increasingly for the extension of freedom, of knowledge, and of the understanding imagination rather than for a rapid multiplication of wants." When asked how he would accomplish Operation Serenity he said, "I have let a bird into the air."

Avenue of the Social Sciences

Public health must consider how best to address itself to these matters. As already suggested, the social sciences provide the main avenue of the present for applying to these great social problems the techniques and concepts which have carried us so far in the natural sciences, in the hope, of course, that new and special techniques and concepts of a fundamental character will emerge, in the hope that the social sciences will have their Galileo, their Newton, their Darwin—or will it be a Michaelangelo or a Milton?

The field is being plowed. A number of schools of public health have social scientists on their staffs.

The Health Information Foundation in the 1955 edition of its Inventory of Social and Economic Research in Health listed 398 active research projects.

The Social Science Research Council has established the Committee on Preventive Medicine and Social Science Research, which is attempting, slowly but with steady progress, to identify and direct attention to areas requiring fundamental research. Shortly, it plans to begin the publication of documents emerging from its discussions with specialists in a number of fields.

A separate but closely related development of first importance is the creation of the Joint Committee on Public Health and the Behavioral Sciences by the American Public Health, Anthropological, and Psychological Associations and the American Sociological Society. This committee is attempting to lower the barriers existing between the public health professions and the social sciences through the organization of campus seminars, workshops, and newsletter abstracts and other publications.

Summary

Public health physicians have at hand in their own communities on a manageable scale the problems of human and community relations which are today harassing the world. At the same time social scientists in increasing numbers are at hand, on neighboring university campuses, in business enterprises, and in departments of government. Thus the tradition of team work in public health need not be stretched far in an effort to delve thoughtfully and deeply into these problems. The answers found will be a part of the storehouse of knowledge and concept that must lead through these troubled times into a more orderly future.

Preventing Injury From Radiation

By JOHN R. HALL, Jr., M.D., M.P.H.

INJURY from ionizing radiation is a phenomenon which, with the advent of nuclear physics, has squarely challenged practitioners of preventive medicine. The everyday uses of ionizing radiation from various natural and man-made emitters can result in low-level, chronic exposure, if not in inadvertent high-level exposure. Exposure to doses well below dramatic levels can result in slowly developing and currently irreversible adverse biological effects in present and future generations. At this time, virtually the only approach to limiting this potential toll is through preventive medicine. After-the-fact therapy is not now promising (*1*).

Rather than present an abstract, general discussion of radiation control, I should like to describe the policies and practices of the Army Surgeon General and his staff, which are applied daily throughout the world. The Army is keenly aware of the activities and contributions of other agencies and works closely with them. The Atomic Energy Commission, always a leader in this field, provides us with much information and guidance, and there are many projects that are joint endeavors of AEC and the Armed Forces. In addition, the National Bureau of Standards and the National Research Council, as well as other agencies, play important roles.

Early Medical Concern

The Army's concern with the problem of radiation injury is based on medical history since Roentgen discovered X-rays in 1895, Becquerel discovered natural radioactivity in 1896, and the Curies isolated polonium and radium in 1897–98. That the potentially harmful effects of radiation were suspected early is borne out by the following quotation from American Martyrs to Science Through the Roentgen Rays (*2*): "Within a period of 90 days after Roentgen's 'Preliminary Communication,' suspicion was aroused in the minds of many investigators that X-rays, or something evolved in the production of X-rays, might have some ill effect on living tissues . . ." Becquerel accidentally burned the skin beneath his vest pocket in which he was carrying a vial of radium. The Curies, too, were burned by radium, Marie accidentally and Pierre deliberately as an experiment. And, as is well known, the deaths of Madame Curie and her daughter, Irène Joliot-Curie, have been attributed to effects of radiation. Madame Joliot-Curie was exposed in a laboratory accident, when she heroically attempted to confine the contents of a broken vial of an intensly active element while she warned her co-workers to flee.

Early concern with radiation injury has been augmented by continuing developments in fundamental and applied radiobiology. Recent reports of the National Research Council (*3*) concerning biological effects of radiations, which are closely paralleled by a report of the British Medical Research Council (*4*), have sharply emphasized the need of preventive action. The National Research Council reports describe the potentially harmful effects of ionizing radiation on this generation and on its posterity, thereby touching upon both the somatic and the genetic effects. They stress the cumulative aspects of chronic exposure, especially genetic. Ionizing radiations have been demon-

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strated to be carcinogenic and to affect the genes. Genetic effects can be created with relatively light doses. The significance of such effects, however, is far from being completely evaluated.

Epidemiological studies are contributing to our knowledge of radiation effects. For example, physicians experience an incidence of leukemia 1.75 times as great as males in the general population (*5*). March has shown that the incidence of leukemia among nonradiologist physicians is 0.44 percent, while the incidence among radiologists is 4.47 percent (*6*). More recently, preliminary analysis of data from a survey of 547 children dying of leukemia and other malignant diseases in England during the period 1953–55 definitely indicates these conditions are most frequent among those whose mothers had X-ray examinations of the abdomen during pregnancy (*7*, *8*).

Potential Effects of Radiation

The following explanation of what may happen when body tissue is irradiated, though greatly simplified and undoubtedly controversial from a technical viewpoint, is useful in discussing radiation injury.

Ionizing radiation produces within a body cell one or more pairs of electrically charged fragments called ions. The number of cells affected depends on the time and intensity of exposure, the volume of tissue exposed, and the character of the radiation. Radiation from external sources is relatively less consequential than radiation from sources lodged in the tissues.

Following the production of ions in a cell, an ion pair may simply recombine or other ion combinations may form. The former event is of little concern, but the latter may cause either alteration or destruction of the cell. Destruction of the cell may contribute to the phenomenon of aging, and the only result will be a shortening of the life span. Alteration of the cell may produce either a benign or a malignant mutation. A benign mutation is not of great concern in a somatic cell, but it could be important in a genetic cell. A malignant mutation may in time form cancerous tissue. Of the potential effects of radiation on body cells then, mutation is most important.

When tissues are exposed to any amount of ionizing radiation, some or all of these effects are possible. Even minimal exposure or background exposure from natural sources contributes to the probability of an untoward effect. Therefore, the theoretical goal in prevention of radiation injury should be limitation of exposure to the absolute minimum.

The National Research Council reports attribute an average accumulated dose of about 4.3 roentgens of external radiation over a 30-year period to background radiation not under man's control; 3 roentgens to the gonads from X-rays; and a projected 30-year external exposure from fallout from testing of weapons, if continued at present levels, of about 0.1 roentgen. (The probable internal exposure is not included in these calculations.) To these exposures must be added potential occupational exposures and exposures from diagnostic or therapeutic uses of radionuclides.

Medical exposure can be controlled by laboratory techniques and equipment put to judicious use. Occupational exposures can most certainly be approached from the viewpoint of preventive medicine.

The Armed Forces have two broad areas of interest in ionizing radiation protection. These are (*a*) the problems associated with nuclear weapons and reactors and (*b*) those not directly so associated. In the Army, the Surgeon General has a special assistant for nuclear energy, who deals primarily with tant. Matters pertaining to microwave hazemitters in medical radiology are within the purview of the chief radiological consultant. Matters pertaining to microwave hazards, nonmedical and nonweapons uses of emitters, and radiological hygiene surveys of Army installations are charged to the chief of the Preventive Medicine Division and are delegated to the Occupational Health Branch. In the newly developing field of nuclear reactors, all these people have important interests.

Scope of the Army's Problem

All of the Army's 1,025,000 military and about 435,000 civilian employees have radiographs taken as part of their preenlistment or preemployment physical examinations. Many

receive additional exposure to X-rays in emergency or periodic examinations. The Army also operates induction stations for the three services. These activities employ hundreds of X-ray installations throughout the free world. These installations, utilizing a variety of machines acquired at various times and initially installed by various agencies and companies, are periodically serviced, calibrated, moved, and checked for radiological hazards. Although some of the work is done by operating personnel, the "disinterested" survey method also is used. This type of survey is conducted by personnel from the Army Environmental Health Laboratory, with the aid of outstanding consultants as necessary.

Six large Army hospitals use radionuclides for medical research and treatment, and a large number of laboratories, arsenals, and industrial-type installations use radioelements in nonmedical research and development, production, and training. Some sources used by the Army are in the order of tens and hundreds of curies in strength. All these must be monitored and surveyed periodically.

All Army users of radionuclides receive them through the standard byproduct procedures established by the Atomic Energy Commission (*9*), with the important exception that all requests must be transmitted through the Office of the Surgeon General. For approval by the Army Surgeon General, a request must show that proper receiving, handling, storage, and disposal facilities and adequately trained and experienced personnel are available. These trained persons assume responsibility for the radionuclides and supervise their use. The Army has excellent rapport with AEC and, in a sense, acts as its agent, although visiting AEC teams are always welcome to conduct checks on the Army's operations, either independently or in conjunction with our personnel.

Disposal of radioactive wastes, a responsibility of the Army Chemical Corps (*10*) with technical advice and supervision from the Surgeon General, is a major problem. Morton and Struxness of the Atomic Energy Commission have pointed out that it may well prove to be one of the limiting factors in achieving optimum benefits from nuclear energy (*11*). Relatively minute quantities of short half-lived radionuclides may be admitted to the sewage system where this practice is allowed and under strict controls. Larger amounts may be stored in appropriate receptacles pending loss of activity. Among other methods tried or studied are burial at sea below the thermocline, at a depth of a thousand fathoms, after casting into concrete or incorporation into an insoluble ceramic mass; ground disposition in certain soils having available ion exchange patterns; and disposition in such natural containment formations as the salt formations in Michigan and Kansas, the regional aquifers in the midwest and the southwest, and the closed valleys in the west.

The Army also has betatrons, industrial X-ray machines, and high-activity radionuclides for industrial radiography or for processing military items. Some radionuclides are being used with considerable success for sterilization of packaged foodstuffs. The Army uses appreciable quantities of naturally occurring radionuclides, such as radium, over which the Atomic Energy Commission now extends no control. The Army has established administrative controls for these materials similar to those for other radioactive substances (*12*).

In cooperation with the other armed services and the Atomic Energy Commission, the Army is now moving into the nuclear reactor field. Our first reactor, water moderated and designed to develop electric power and heat, has recently been completed at Fort Belvoir, Va., near Washington, D. C. This reactor, because it is near a population center, is in a building designed, according to AEC standards, to contain fully any contamination from radionuclides. The design conforms also with recommendations of the National Research Council (*3a*).

An ultimate goal for the Army in this field is an easily transported or even mobile reactor to provide heat and power in remote areas of the world where logistics of conventional fuel supply are burdensome and costly. Currently, the Army is on the threshold of this goal with a stationary prototype and can be expected to move rapidly into various applications with the accumulation of knowledge and experience. The Army Medical Service expects medical problems from power reactors to grow and is preparing for that eventuality.

Protection of Army Personnel

Army regulations require individual dosimetry, or inventory, for all personnel in an environment heavily exposed to ionizing radiation (*13*). Accurate cumulative records must be kept in a manner prescribed by tri-service regulation (*14*). In continental United States, Army installations receive film badge service from the Lexington Signal Depot (*15*), which provides the badges and the film on an appropriate periodic schedule. Exposures above 300 milliroentgens per week are reported to the installation and to the Surgeon General by telegram or telephone. If gross or multiple overexposures are indicated, technicians are sent to the installation to help pinpoint and correct the difficulty.

Many believe that the Army control measures are more severe than those of civilian counterparts. If so, it is only in adherence to common sense and to existing standards and regulations. We scrupulously observe the Atomic Energy Commission's requirements. We use the data of the various National Bureau of Standards handbooks, some of which we have borrowed wholly or in part and reissued as Army bulletins and directives. When newer information dictates or suggests modifications in these data, we publish and enforce the changes. We also issue publications specially developed for the Army.

The Army attempts to learn and comply with State and community requirements. In that respect, two pleas are in order. First, when regulations for a State or a locality are issued, we ask health officials please to send copies to the surgeons general of the three services. Second, we ask everyone to remember that the control of ionizing radiations is important to national health. As in motor vehicle or air control, maximum standardization of codes, symbols, marking, regulations, and restrictions is desirable. The practices of New York State, where National Bureau of Standards handbooks and related or similar documents and procedures are used extensively, are exemplary in this respect.

Summary

The Army's main concern with respect to prevention of radiation injury is the protection of the individual against unnecessary exposure to ionizing radiation. We consider all ionizing radiations to be potentially harmful. Our approach is essentially preventive. We try to foresee the hazards, design protective facilities and procedures, keep accurate records of users and uses, provide maximum protective and monitoring devices at each installation, and then check by disinterested survey to assure local competence and adherence to prescribed procedures and to detect hazards otherwise overlooked. National and local monitoring and investigation of noteworthy exposure support this effort.

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technical publications

Health and Demography

PHS Publication No. 502. 1956. By Halbert L. Dunn, M.D. 94 pages; illustrated. 50 cents.

Population trends and developments pertinent to present and future public health programs have been collated in this graphic presentation.

The condensed data are presented in five sections: the dynamics of population trends in the United States; population trends for major geographic areas and States; population characteristics; age and marital status; economic status and indicators of health and disease. A foreword and a postscript present the views of the author.

Directory of State Standard-Setting Authorities for Hospitals and Medical Facilities

PHS Publication (unnumbered). 10 pages. 1956.

This publication entitled "Directory of State Agencies Having Primary Legal Responsibility for Standards of Maintenance and Operation of Hospitals, Nursing Homes, Homes for the Aged, and Other Similar Facilities Except Those Operated by Federal and State Governments" briefly shows in tabular form the responsibilities of various State agencies administering or licensing seven types of medical facilities. An accompanying index lists names and addresses of these agencies.

Intended as an aid to State, local, and other health agencies in planning and administering their programs, this pamphlet was published by the Division of Hospital and Medical Facilities (administering body of the Hill-Burton Hospital and Medical Facilities Survey and Construction Program).

Industrial Waste Guide to the Commercial Laundering Industry

PHS Publication No. 509. 1956. 8 pages; illustrated. 15 cents.

Intended primarily to aid workers in the water pollution control program, this handbook was prepared by the Stream Pollution Abatement Committee of the American Association of Textile Chemists and Colorists in cooperation with the American Institute of Laundering. It was submitted for publication to the Public Health Service through the National Technical Task Committee on Industrial Wastes.

Laundry supervisors will find this publication a concise practical guide for operation of washrooms with a minimum of waste material. A section on waste treatment suggests possible solutions to stream pollution which cannot be corrected by waste reduction procedures. Some performance data are included on various waste treatment processes. The value of waste reduction methods in lowering total waste treatment costs also is emphasized.

The Circulatory System

Illustrated Guide for Nursing Education

PHS Publication No. 482. 1956. 64 pages; illustrated. 45 cents.

Designed for nursing education in cardiovascular disease, this booklet contains 20 colored diagrammatic figures with explanatory text.

This guide is also intended as a timesaver for nursing school instructors, for individual nurses, and for staff education in hospitals, industry, and public health agencies.

The schematic drawings used are reproductions from the set of colored slides on the circulatory system, produced in 1954 by the Public Health Service, and used widely in nursing education.

This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.

Identification of Two Leptospiral Serotypes New to the United States

By MILDRED M. GALTON, DOROTHY K. POWERS, STURGIS McKEEVER, and GEORGE W. GORMAN

RECENTLY, two leptospiral serotypes not found previously in the United States were isolated from the kidneys of wild animals collected in southwest Georgia (*1*). The identity of these two serotypes, one a member of the *mitis-hyos* serogroup, the other belonging to the *australis* A serogroup, is recorded in this paper.

Relatively few leptospiral serotypes have been isolated in the United States, probably because of the limited number of medical and veterinary laboratories providing appropriate diagnostic service. *Leptospira icterohemorrhagiae*, the first serotype isolated in this country, was obtained from wild rats in 1917 (*2*) and from man in 1922 (*3*). Since that time, four other serotypes, *Leptospira canicola* (*4, 5*), *Leptospira pomona* (*6–8*), *Leptospira autumnalis* Fort Bragg (*9*), and *Leptospira ballum* (*10*), have been identified in the United States. Serologic evidence has indicated that infection with strains related to *Leptospira bataviae* (*11*), *Leptospira sejroe* (*12, 13*), *Leptospira grippotyphosa* (*14*), and *Leptospira pyrogenes* (*15*) may exist, but these serotypes have not been isolated.

The authors are with the Communicable Disease Center, Public Health Service. Mrs. Galton, of the Epidemiology Branch, is bacteriologist in charge, Leptospirosis Research Laboratory, Chamblee, Ga. Mrs. Powers, now retired, was formerly a bacteriologist with that laboratory. Dr. McKeever, a biologist, and Mr. Gorman, a bacteriologist, are with the Technology Branch and are assigned to the Newton Field Station in Georgia.

Four of the cultures of leptospirae included in this study were isolated from the kidneys of opossums trapped on two plantations in Baker and Dougherty Counties, Ga., in September and October 1955. These were designated LT79, LT81, LT82, and LT85. Two additional cultures, designated LT95 and LT102, were isolated from the kidneys of two raccoons trapped on a plantation in Decatur County, Ga. All cultures were tested first against immune serums of *L. autumnalis*, *L. ballum*, *L. canicola*, *L. icterohemorrhagiae*, *L. pomona*, and *L. sejroe*, the usual battery used to test leptospiral isolations received from the Communicable Disease Center field station in Newton, Ga., and then with immune serums representative of the remaining 14 serogroups.

Procedures

Preparation of antiserums. Immune serums were prepared by intravenous inoculation of normal rabbits weighing 8–9 lbs. with successive doses of 1.0-ml., 4.0-ml., 4.0-ml., and 6.0-ml. amounts of a 4- to 6-day-old culture of each leptospiral strain grown in Stuart's medium (*16*) and killed by the addition of 0.3 percent formalin. The 4 injections were given at 5- and 7-day intervals. Seven days after the last inoculation the rabbits were bled from the heart. Serum yield averaged 75 ml. per rabbit. After the addition of 50 percent glycerine as a preservative, the serums were stored at 40° F.

Preparation of antigens. Leptospiral strains used for antigen production were maintained in

Stuart's medium and transferred twice weekly. Such actively growing seed cultures were used in approximately 1:10 to inoculate the desired amount of Stuart's medium in screw-capped prescription bottles. The inoculated bottles were incubated 4–5 days at 28°–30° C. and then examined by dark-ground microscopy for density and smoothness. If the antigens appeared satisfactory, 0.3 percent formalin was added, and they were allowed to stand overnight at room temperature. They were centrifuged for 10 minutes at a speed of 1,500×gravity (about 3,000 r.p.m. on a No. 1 International Centrifuge) to remove debris or precipitate. The supernatant was decanted and was then ready for use.

Agglutination test procedure. Serial twofold dilutions of serum in 0.85 percent saline, starting with 1:8 through 1:32,768, in a final volume of 0.2 ml. were prepared. To each serum dilution, 0.2 ml. of antigen was added. The tubes were shaken, incubated in a water bath at 52° C. for 2 hours, and then refrigerated for 1 hour. A drop from each tube was examined by dark-ground microscopy using low-power objective, and 10× oculars without a coverslip. The degree of agglutination was read as 1 plus, 2 plus, 3 plus, 4 plus, or negative. A reaction was recorded as 4 plus when all leptospires appeared clumped, 3 plus when approximately 75 percent of the organisms were agglutinated, 2 plus with 50 percent agglutinated, and 1 plus with 25 percent agglutinated. The end point was taken as the last dilution showing a 1 plus reaction.

Agglutinin absorption procedure. Antigens for absorption studies were prepared from 5- to 6-day-old cultures grown in Stuart's medium and killed by the addition of 0.3 percent formalin. After standing at room temperature overnight, the cultures were centrifuged for 10 minutes at 1,500 × gravity to remove extraneous material. Ten to twenty milliliters of the supernatant were put aside to be used later as antigen for testing the absorbed serum. The remainder of the supernatant was centrifuged for 15 minutes at 9,000 × gravity in a Servall. The supernatant was discarded, and the desired amount of a 1:20 dilution of serum was added to the packed cells. The cells were resuspended using a 2.0-ml. Cornwall pipette with a 4-inch, 17-gauge needle. After incubation of the serum-cell mixture in a 50° C. water bath for 2 hours and overnight at 28°–30° C., the cells were removed by centrifugation and the serums absorbed a second time by the same procedure but without overnight incubation. If necessary, a third absorption was carried out. Absorptions were considered complete when agglutinins were completely removed by the homologous antigen. Microscopic agglutination tests with the absorbed serums were performed by the procedure described above except that the initial dilution was 1:40.

Findings

None of the cultures in this study agglutinated when tested against the usual battery of leptospiral immune serums.

The mitis-hyos serogroup strains. Culture LT79 was agglutinated by *Leptospira mitis* Johnson antiserum to 25 percent of the titer, by *Leptospira hyos* antiserum to 6 percent of the titer, by *L. bataviae* antiserum to 3 percent of the titer, and by *L. pyrogenes* antiserum to less than 1 percent of the titer. An antiserum prepared against strain LT79 agglutinated to the homologous titer *L. mitis* and *L. hyos* antigens. Cross agglutinin absorption tests performed with *L. mitis* and *L. hyos* indicated that LT79 is closely related to both strains but not antigenically identical with either, as shown in table 1. (A subculture was sent to Col. Maurice Hale, Division of Veterinary Medicine, Walter Reed Army Institute of Research, Washington, D. C., who confirmed our findings.) This new serotype is tentatively designated *Leptospira bakeri.*

According to Wolff (*17*), the retention of at least 10 percent of the homologous titer is the criterion for heterologous strains. Alexander and his co-workers (*18*) modified Wolff's scheme slightly to conform to their dilution scheme and considered 6.2 percent ($\frac{1}{16}$ of homologous titer) as the breakpoint for a heterologous serotype.

Culture LT85 also was agglutinated to 25 percent of the titer by *L. mitis* antiserum. It reacted to the homologous titer with LT79 antiserum, and in absorption tests it completely removed the agglutinins for LT79. Absorption

Table 1. Results of cross agglutinin absorption tests with LT79, Leptospira hyos, and Leptospira mitis Johnson [1]

Antiserum	Antigen		
	L. hyos	*L. mitis*	LT79
Leptospira hyos			
Unabsorbed	16, 768	16, 768	1, 024
Absorbed with:			
L. hyos	(2)	(2)	(2)
L. mitis	640	(2)	(2)
LT79	5, 120	5, 120	(2)
Leptospira mitis			
Unabsorbed	4, 096	4, 096	1, 024
Absorbed with:			
L. hyos	(2)	(2)	(2)
L. mitis	(2)	(2)	(2)
LT79	640	640	(2)
LT79			
Unabsorbed	4, 096	4, 096	4, 096
Absorbed with:			
L. hyos	(2)	(2)	80
L. mitis	(2)	(2)	40
LT79	(2)	(2)	(2)

[1] Titer expressed as reciprocal of serum dilution.
[2] No reaction in a 1:40 dilution.

studies indicate that LT79 and LT85 are homologous serotypes.

The other two cultures in this group, LT81 and LT82, appear to be related to the *mitis-hyos* serogroup and to the two new isolates but are not identical with either, as shown in table 2. When LT79 antiserum was absorbed with LT81 and LT82 antigens, these antigens failed to remove the homologous agglutinins by 15 percent. In the initial agglutination tests LT81 reacted to 25 percent of the titer of *L. mitis* antiserum, but LT82 reacted to only 6 percent. Thus, further serologic study is needed to determine the exact relationship of these two strains.

The australis A serogroup strains. Cultures LT95 and LT102 were agglutinated to the homologous titer with *Leptospira australis* A Ballico antiserum. An antiserum prepared against LT95 agglutinated the Ballico strain to 12½ percent of its homologous titer. As shown in table 3, absorption studies revealed that Ballico serum retained 2 percent of its titer when absorbed with LT95 cells, and LT95 serum retained only 1 percent of its titer when absorbed with Ballico cells. Thus, except for minor differences, LT95 is indistinguishable from *L. australis* A Ballico.

Comment

L. mitis was isolated first by Johnson (*19*) in 1940 in Australia from humans with benign leptospirosis. All patients had been in contact with pigs or cattle. It has been isolated since from pigs (*20*) in Australia, and serologic evidence suggests that infections occur in cattle. Clinically and epidemiologically, *L. mitis* infection closely resembles *L. pomona* infection.

L. hyos was isolated by Savino and Rennella (*21*) from humans with mild leptospirosis and from swine in Argentina. Babudieri (*22*) studied both the *L. mitis* Johnson and the *L. hyos* strains and reported that they were serologically identical. However, further examination of these strains by A. D. Alexander, Walter Reed Army Institute of Research, showed that *L. hyos* is a complete biotype of *L. mitis* Johnson. The results of the present study substantiate Alexander's observations.

L. australis A was identified by Lumley (*23*) in 1937 from canefield workers in Queensland. Clinical symptoms were reported to be severe. Stagnant water in the canefields yielded the organisms, and a native rat (*Rattus conatus*) was

Table 2. Results of agglutination and cross agglutinin absorption tests with Leptospira mitis Johnson, LT79, LT81, LT82, and LT85 [1]

Antiserum	Antigen			
	LT79	LT81	LT82	LT85
Leptospira mitis				
Unabsorbed	1, 024	1, 024	256	1, 024
LT79				
Unabsorbed	4, 096	256	256	4, 096
Absorbed with:				
LT81	640	(2)	------	------
LT82	640	------	(2)	------
LT85	(2)	------	------	(2)

[1] Titer expressed as reciprocal of serum dilution.
[2] No reaction in a 1:40 dilution.

Table 3. Results of cross agglutinin absorption tests with Leptospira australis A Ballico, LT95 and LT102 [1]

Antiserum	Antigen		
	Ballico	LT95	LT102
Leptospira australis A Ballico			
Unabsorbed	2,048	2,048	2,048
Absorbed with:			
Ballico	(2)	(2)	(2)
LT95	40	40	----
LT95			
Unabsorbed	1,024	8,192	8,192
Absorbed with:			
Ballico	(2)	80	----
LT95	(2)	(2)	----
LT102	----	(2)	(2)

[1] Titer expressed as reciprocal of serum dilution.
[2] No reaction in a 1:40 dilution.

found to be the principal animal carrier. Recently, two additional strains of the *australis* A serogroup have been found, one in Australia (*24*) and the other in Malaya, according to Alexander. Further studies with these and with the isolations from raccoons will be done to determine the exact relationships.

The identification of these strains in the United States further emphasizes the importance of serotyping all leptospirae isolated. In addition, inclusion of *L. mitis* or *L. hyos* and *L. australis* A cultures in the battery of antigens employed in the agglutination and agglutination lysis tests in diagnostic medical and veterinary laboratories must now be considered.

Summary

Four strains of leptospirae isolated from opossums, belonging to the *mitis-hyos* serogroup, and 2 strains from raccoons, belonging to the *australis* A serogroup, have been identified. Cross agglutinin absorption studies indicate that the opossum strains are not identical with *Leptospira mitis* Johnson or *Leptospira hyos*, but that they represent at least one new serotype, tentatively designated *Leptospira bakeri*, within the serogroup and possibly one other serotype. Further studies are being done to determine the exact relationships.

Two cultures from raccoons were shown by cross agglutinin absorption studies with *Leptospira australis* A Ballico to be within the range considered acceptable for homologous serotypes.

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Since this work was completed, we have learned of a new serotype of the mitis-hyos group. The new leptospiral serotype, designated Kisuba, was isolated in the Belgian Congo (25). The tentative designation of LT79 as Leptospira bakeri is suggested until its relationship with strain Kisuba is established.

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Advisory Committee

Surgeon General Leroy E. Burney has appointed a committee of physicians to advise him on Public Health Service activities related to the practice of medicine. The first meeting of the new Advisory Committee on Medical Practice Relations was held on April 4–5, 1957, in Washington, D. C.

Dr. Burney said that with the growth of medical and related research, it has become increasingly important to work with private physicians as well as with health agencies in applying new knowledge promptly and effectively.

Members of the committee are Dr. Stuart Adler, Albuquerque, N. Mex.; Dr. C. Byron Blaisdell, Asbury Park, N. J.; Dr. Hugh H. Hussey, Washington, D. C.; Dr. W. L. Portteus, Franklin, Ind.; Dr. Julian P. Price, Florence, S. C.; Dr. Stanley R. Truman, Oakland, Calif.; and Dr. William B. Walsh, Washington, D. C.

Public Health Residency Training

By S. P. LEHMAN, M.D., M.P.H., and D. R. PETERSON, M.D.

"I DIDN'T KNOW there was such a thing." We have heard this statement repeatedly from intern and practicing physician alike. The "thing" they refer to is the residency program in public health. While residencies in clinical specialties are well known and accepted, such is not the case in the field of public health. Perhaps this is because the specialty is only about 8 years old. By June 30, 1956, only 1,684 certificates had been awarded in public health.

Residencies for physicians interested in public health as a specialty have evolved since the incorporation of the American Board of Preventive Medicine and Public Health in 1948. The board was formed on the recommendation of a joint committee of the American Medical Association and of the American Public Health Association. It was created in accordance with action of the Advisory Board for the Medical Specialties and was recognized and approved as a medical specialty board by the Council on Medical Education and Hospitals of the American Medical Association in 1949 (*1*). The purpose of the board is twofold:

- To encourage the study, improve the practice, elevate the standards, and advance the cause of preventive medicine.
- To grant and issue to physicians, duly licensed by law to practice medicine, certificates of special knowledge in the various fields of preventive medicine. The fields in which certification is granted are public health, aviation medicine, and occupational medicine.

Dr. Lehman and Dr. Peterson are with the Seattle-King County Department of Public Health, Seattle, Wash. Dr. Lehman is director of the department, and Dr. Peterson, a former public health resident with the department, is a district health officer.

To be eligible for examination by the American Board of Preventive Medicine, candidates must meet certain general requirements. These pertain to character, professional demeanor, medical education, internship, and medical licensure. Additional requirements for public health candidates are:

1. Successful completion (after internship) of at least 1 academic year of graduate study leading to the degree of master of public health or an equivalent degree or diploma; or training or study decreed by the board to be substantially equivalent to such graduate study.
2. Residency (after internship) of at least 2 years of field experience in general public health practice, which includes planned instruction, observation, and active participation in a comprehensive, organized public health program, 1 year of which may be an approved clinical residency in a field directly related to public health.
3. A period (after internship) of not less than 3 years, in addition to 1 and 2 above, of special training in, or teaching or practice of, public health.
4. Limitation of practice to full-time teaching or practice of public health as a specialty.

In 1955–56 the Residency Review Committee for Preventive Medicine and Public Health (*2*) had approved residency programs for 2 years of field training in 15 States (see map). In 12 States, 35 local areas were designated as satisfactory for field training; 2 were approved on a statewide basis; and 1 was given provisional approval.

Through a questionnaire sent in September 1956 to all the States known to have a program, we learned that 42 residents had been trained since 1950; 26, or 62 percent, of these residents were doing full-time public health work. Sixty-three appointments were available, but only 19 (30 percent) were filled (see table).

The picture was similar in 1954–55, when only 26 (37 percent) of the 71 available appointments were filled: 21 of the 65 first-year appointments available and 5 of the 6 second-year appointments.

Why so small a percentage of the available residencies are filled is inexplicable. Perhaps too few physicians have been told about the program.

Seattle-King County Program

The Seattle-King County Department of Public Health in Washington has sponsored a residency program in public health since 1952. Our experiences may be of interest to the profession at large as well as to those who are personally involved in postgraduate medical education.

The program adopted by the Seattle-King County Department of Public Health in 1952 began with one resident who, quite literally, had to "play by ear." After completing 1 or 2 months' time in a given service, he selected another for his next assignment. His notes and special studies helped the department to correct some of the deficiencies of the program and to see where the resident would profit by additional supervision or advice. The lack of a basic curriculum was perhaps the worst fault of the first year.

A second candidate, accepted in 1953, left for a residency in surgery before he had finished training. Perhaps we erred in not scrutinizing the intentions and qualifications of the applicant with sufficient care.

States with residencies in public health and preventive medicine, 81 positions, 1956.

Two residents were accepted for 1954. Their work together in activities that consisted mostly of observation and study enabled them to talk over the experiences of the day, make plans for the next week's program, and, when necessary, bolster one another's morale. A schedule assured their spending a definite period of time in each service. During the remainder of the year, the residents were assigned to a district office where they assumed responsibility gradually as their experience and knowledge accumulated. This arrangement proved so satisfactory that two additional residents were accepted in 1955.

Curriculum

The men who have participated in our program as residents have come to us from the hectic and demanding routines of internship or private practice where they were preoccupied with problems of individual patients. To change their professional frame of reference so that they see an entire community as their patient requires time, study, and some degree of personal reorientation as well as specific instruction in technical disciplines. Therefore, the resident's curriculum is designed to present fundamental disciplines of preventive medicine and public health during the first 6 months. At the same time it is sufficiently flexible and leisurely to enable the resident to take advantage of training opportunities that may arise outside the health department, such as special courses at the University of Washington or those sponsored by other agencies, public health meetings, and conferences with visiting experts.

Our curriculum consists of the following four basic subjects:

	Months
Public health administration	1
Community resources	1
Preventive medicine	2
Environmental sanitation	2

Public Health Administration

From the beginning, the director of public health has supervised the residents during their first 2 months in the health department. No one is in a better position to introduce the resi-

dents to the health department personnel, to the community, and to the history, resources, and peculiarities of the area in which they will work.

From the vantage point of the director's office, the residents see the whole operation, though they are not necessarily expected to understand the significance of all that they see during this first exposure. They are included in staff conferences, committee meetings, discussions of personnel problems, hearings before the city council, and discussions of proposed ordinances and other related business of the department, with the anticipation that they will catch the "sense" of what is going on. Interstaff committee work, writing assignments, helping with correspondence, and similar activities of routine office management help them relate to the organization and feel that they are on the team from the start.

Community Resources

Knowing the community is to the public health physician what knowing anatomy is to the surgeon. Here again the director, with his experience and knowledge, can point out the more important community resources within his jurisdiction. The residents then take the initiative in visiting as many of these organizations as time permits. Among these organizations are other official public health agencies, various volunteer health organizations, industrial medical departments, prepaid medical service organizations, hospitals, group practice clinics, the juvenile court with its satellite service groups, jails, a screening-examination center, and medical rehabilitation facilities. Other governmental organizations, Federal, State, and local, complete the itinerary.

Preventive Medicine

The preventive medicine portion of the curriculum represents more or less familiar ground to the residents and offers them an opportunity to exercise some of the talents developed by their hard-won medical education and experience.

Approximately 3 weeks are devoted to tuberculosis control. Under supervision, trainees participate in outpatient clinics and review the

Status of appointments in 14 public health residency programs, 1956

Appointments	Number available	Filled	
		Number	Percent
Total	63	19	30
1st year	35	7	20
2d year	28	12	45

miniature films taken by the various mobile X-ray units. They accompany the State tuberculosis control officer, or his deputies, to other health departments to observe the conduct of outlying clinics and consultations. They are invited to staff meetings at the sanatoriums and are urged to attend whatever professional meetings are being held at the time.

Well-child clinics are held throughout the local health department's jurisdiction. The residents are expected to staff some of these clinics and to familiarize themselves with the type of service offered. Special projects and courses have been devised to help them comprehend the concepts of child health and the significance of morbidity and mortality statistics. Programs for crippled children, for sight and hearing conservation, and for medical care for children are included in their assignments. They are also urged to attend the clinical presentations at the University of Washington or the Children's Orthopedic Hospital and to study the operation of the newly formed poison control center.

Through worn shoe leather and perseverance the aspiring health physician learns the elements of communicable disease control and epidemiology, for he is asked to assume responsibility for making appropriate investigations when indicated. The facilities of all the hospitals that accept communicable disease cases are available in the event of an unusual or interesting case or outbreak. Practical problems of disease reporting, levels of community immunizations, cooperation with other official departments, control regulations and their enforcement, to mention only a few, point up some of the challenges of this aspect of preventive medicine to the residents.

The special case of venereal disease control

offers the resident insight into the productive teamwork of the astute clinician and the special investigator. The unique records (example: nickname file), the conduct of the clinic, the examination of patients, the special training of the investigators, and the occasional positive dark field examination are some of the highlights of this service.

Environmental Sanitation

A large departmentalized sanitation division affords the residents ample opportunity to see this aspect of public health practice at first hand with a well-qualified person to instruct them. A typical experience in the milk section, for an example, includes an early morning briefing in the main office, followed by a visit to the farm, milk receiving plant, milk processing plant, and then, perhaps, to the laboratory to witness the elucidation of a consumer complaint. Technical factors influencing grade, control of pasteurizing equipment, public relations with milk producers, and a host of other problems are explained. To illustrate the geographic differences in the program, the resident is taken to several areas in this milkshed, which literally surrounds the entire Puget Sound.

This same general type of instruction is given in the other sections: general sanitation, meat, plumbing, plague and vermin control, sewerage installations, and water works. It is in the sanitation division that the resident gets a better view of public health work at its grass roots level than anywhere else.

Completion of Training

Following his indoctrination, the resident is assigned to one of three district health offices situated strategically on the periphery of the metropolitan area. Each district health office serves both a rural and an urban population, with public health problems which are, we feel, representative of those he might expect to meet in the future.

He can confer with experienced personnel on any problem that he feels he cannot solve by himself. Moreover, since his tenure in this post is about 21 months, he has sufficient opportunity to become established in the community and to learn the elements of public relations which, in our area at present, involve participation with local health councils, municipal organizations of many descriptions, school personnel, radio and newspaper representatives, and similar groups. As often as is practical and within budgetary limitations, this resident, now a district health officer, is encouraged to attend both local and national meetings of public health workers in order that he may better identify himself with this group of medical specialists.

After some 27 months with this health department, the resident attends a school of public health of his own choosing. While at school he is given a monthly stipend as well as tuition and travel funds. When he has completed his academic work and received the master of public health degree, or its equivalent, the resident has fulfilled the formal training requirements of the American Board of Preventive Medicine.

Comments

Inherent in a residency program are features that benefit both resident and health department. How these are integrated into the operation to maintain an equitable balance between values received by each is shown in the inset.

We have been fortunate in getting physician applicants with varied backgrounds. Two had worked in health departments previously, one as a sanitarian and the other as a statistician. Others have come directly from internship, from military service, or from private practice. These men have been intent on making public health a career. Like their counterparts in the clinical specialties, they hope to become accredited specialists in their chosen field. They anticipate training that will enable them to act as consultants to physician and layman alike in medical matters that pertain to the community. The excellent scholastic records of our residents who have matriculated in schools of public health attest to the seriousness of their intentions. We like to feel that careful selection of candidates and broad practical field training contribute to this achievement.

After basic orientation each resident sets his own pace in assuming responsibility for clinics, programs, and planning. However,

Balance in Benefits

Resident	Health Department
AMA-approved postgraduate training	Stable, well-trained medical staff
Increasing responsibility and status	Relief of regular staff (members)
Contact with professional colleagues	Improved relations with doctors and hospitals
Reasonable salary for family maintenance	Just compensation for service
Association with University Medical School	Recruitment and teaching responsibilities met
Modest research activity and special projects	Results of research sometimes applicable

competent advice is no farther away than the telephone. At a time when the resident's convictions concerning his chosen specialty may be conditional, supervision of this nature mitigates against discouraging mistakes without suppressing initiative. As the resident's capabilities become apparent, responsibility can be delegated in areas that will relieve some of the regular staff.

The resident must become a part of his community and win the confidence of his professional colleagues in that community. He is encouraged to join the medical society and other organizations relevant to his position as district health officer. This representation personalizes the health department on a district level and brings its programs closer to the communities for which they are intended.

Our initial stipend is $500 per month the first year. The resident through his work in clinics, immunization programs, and other activities actually earns his stipend as much as the hospital resident who performs as house physician. Consistent with increasing responsibility and ability, the stipend is raised to $800 per month the second year.

Each resident is appointed assistant clinical instructor in public health at the University of Washington Medical School. In this capacity he is expected to assist in teaching public health to medical students and to participate in special seminars and courses, all of which help to fix concepts and material in his mind that he has only recently learned himself. If, by precept or example, a student is encouraged to choose public health as a career, the resident contributes to recruitment of personnel.

Project activity in our residency program has been both diverse and productive. Residents have contributed significantly to the following: civil defense and disaster preparedness program; publication of a public health reference manual for physicians; poliomyelitis survey; poliomyelitis immunization program; district office administration; investigation of a multiple-puncture tuberculin test (Heaf test); medical consultation for State vocational rehabilitation division.

We have been asked whether a physician with public health experience but without formal training should undertake a residency such as ours. We cannot answer this question categorically, for some physicians have been interested in the orientation part of our program. Certainly a new staff member could profit from thorough orientation to our community and the department. However, our program is primarily designed for training the uninitiated physician in the disciplines he will find essential to his pursuit of a career in public health.

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Conjunctivitis in Southwest Georgia

By RICHARD P. DOW, Ph.D., and VIRGINIA D. HINES, B.S.

ACUTE CONJUNCTIVITIS, commonly known as "sore eyes," is endemic in various sections of the southern United States. The disease erupts seasonally, reaching high levels of prevalence each summer. Its incidence seems closely related to the seasonal and geographic abundance of "eye gnats" of the genus *Hippelates*. Because of this association, *Hippelates* is not unreasonably considered as a possible vector of conjunctivitis.

The disease occurs mostly in younger children, in uncomplicated cases without any known sequelae. In this country it does not appear to be associated with the spread of trachoma. On the other hand, in a region such as southwest Georgia, where conjunctivitis is endemic, it is a cause of much illness. Most rural preschool children have at least one case of conjunctivitis each summer, and among older children, the disease is a cause of much school absenteeism during the fall (*1*).

Studies in the Rio Grande Valley in Texas indicated that most cases of sore eyes in that area were due to *Haemophilus aegyptius*, the Koch-Weeks bacillus (*2*, *3*). Additional unpublished studies conducted by Dr. Dorland J. Davis of the Public Health Service demonstrated similar etiology in the vicinity of Thomasville, Ga. Here the Koch-Weeks organism was found to exhibit seasonal abundance corresponding to that of observed sore eyes and also to occur more frequently than *Haemophilus influenzae* in cultures of eyes having signs of conjunctivitis.

The authors are with the Communicable Disease Center, Public Health Service. Dr. Dow is a biologist at the Logan Field Station Section, Technology Branch, Logan, Utah, and Miss Hines is a nurse epidemiologist with the Leprosy Control Program, assigned to the Louisiana State Department of Health, New Orleans, La.

Collection and Analysis of Data

The present paper describes a house-to-house epidemiological study of conjunctivitis in the rural town of Barwick, Ga., near Thomasville. The field observations were made between May 17 and October 29, 1951. The study population of 486 persons included nearly every family within a mile of the Barwick railroad station and was fairly evenly distributed between white and Negro persons and between the sexes. Children less than 15 years of age included 33 white males, 49 white females, 45 Negro males, and 51 Negro females. The families were first visited in two groups: one group on May 17th and 18th and the other on June 5th and 6th. Thereafter each group was visited alternately at 2-week intervals except for one 3-week interval in October.

During the house-to-house visiting, information on eye symptoms and on cases of sore eyes was elicited for each member of the family. The informant was usually the mother or another woman tending the household. No cultures were taken, but the eyes of every available person were examined for signs of conjunctivitis.

For the analysis of the data from this study, a case of conjunctivitis is defined as an illness which was called conjunctivitis or sore eyes by either the observer or the informant. Ages are fixed at the number of whole years of age at the end of July 1951. This procedure leads to some inaccuracy but most of the observations still fall within the correct year of age. Case

attack rates are expressed as the number of cases times 100 per person-periods of experience. (The word "experience," as used here, means the sum of the unit periods of time covered by the interviewing.)

In the 11 rounds of visiting, the study population of 486 persons might have contributed a maximum of 11 times 486, or 5,346, person-periods of experience; 4,062 person-periods, or 76 percent of this maximum, were actually obtained. Fifty-six percent of the total experience was supplemented by physical examination of the eyes, the total number of examinations being 2,275. The number of eye examinations was disproportionately small for the males over 14 years old; and at the opening of the schools in September, there was a very marked drop in the number of eye examinations in the children of ages 5–14 inclusive. With these exceptions, the sampling of the study population was not unbalanced. No denominators have been adjusted to exclude either persons with chronic conjunctivitis or persons who might have acquired immunity to the disease.

Age, Race, and Sex

Preliminary analyses of the data showed no marked difference in conjunctivitis attack rates between male and female persons of all ages or between white and Negro persons of all ages. It was apparent from the start, however, that the rates were much higher in children. In fact, only 17 of all the 123 cases occurred in the persons over 9 years old who made up 70 percent of the study population.

With respect to age, the rates for white and Negro children are found to differ markedly, yet rates for both races decrease rapidly after an early peak (table 1). In the white group, the highest attack rate occurs in two separate years (ages 2 and 3). In the Negro group, the highest attack rate occurs at age 1.

When the attack rates for white and Negro children are compared by age groups, the rate for children 1–4 years of age is found to be distinctly higher in the white population than in the Negro population (table 2). When the rates for both sexes are compared without separation as to race, the attack rates for males are higher, but only slightly so, for less than 1, 1–4, and 5–9 years.

Of course the attack rates, based on numbers of cases, are strongly influenced by the informant's definition of a case. Different individuals might count as one case, or as two cases, a single infection which had two separate periods when the signs and symptoms were more severe. In the present study as many as five cases have been reported in one individual (table 3).

Table 1. Conjunctivitis case attack rates in southwest Georgia, by age and race, May 17–October 29, 1951

Age (years)	White				Negro			
	Persons	Cases	Experience [1]	Rate [2]	Persons	Cases	Experience [1]	Rate [2]
Less than 1	7	3	62	4.8	13	4	71	5.6
1	9	7	90	7.8	11	12	88	13.6
2	7	13	60	21.7	9	6	82	7.3
3	7	13	60	21.7	12	6	94	6.4
4	8	13	74	17.6	9	1	74	1.4
5	7	4	73	5.5	7	6	65	9.2
6	6	7	50	14.0	6	1	53	1.9
7	5	3	46	6.5	2	0	17	.0
8	5	2	48	4.2	5	1	42	2.4
9	3	3	29	10.3	6	1	53	1.9
10–14	18	2	167	1.2	16	3	137	2.2
15–19	12	0	102	.0	13	0	114	.0
Over 19	182	5	1,647	.3	101	7	664	1.0
Total	276	75	2,508	3.0	210	48	1,554	3.1

[1] Person-periods.
[2] Cases × 100 per person-periods of experience.

Table 2. Conjunctivitis case attack rates and percentages of children affected in white and Negro populations, May 17–October 29, 1951

Age (years)	Case attack rates		Percentages of persons affected		
	White	Negro	White	Negro	P [1]
Less than 1	4.8	5.6	43	31	>.90
1–4	16.2	7.4	81	49	<.02
5–9	7.7	3.9	58	27	.05
10–14	1.2	2.2	11	19	>.80

[1] Probability of null hypothesis (that no difference exists between the percentages for whites and Negroes).

Since it is often a matter of opinion as to when one case has recovered and another has begun, the number of separate cases is a less objective figure than the number of persons affected by sore eyes. The numbers of whites and Negroes who were affected and the numbers who were not affected at some time in the course of the study can be compared by fourfold analysis. This method shows that the proportion of white children attacked by sore eyes is significantly higher than the proportion of Negro children in the age groups 1–4 and 5–9 years (table 2). When the numbers of male and female children affected and not affected by sore eyes are similarly compared, the results again reflect the case rates, and there is no evidence of a difference in rates between the sexes.

Duration of Illness

The finding of differences in attack rates between the white and Negro children led to a study of other differences in the two groups. Besides 11 cases of conjunctivitis for which total length was not recorded and 7 cases which may or may not have been recovered on the day of the last pertinent interview, there are 46 recovered cases and 60 cases last reported as active. In Negroes, the cases are of longer average duration whether or not they were active at the time of the last interview, and this is true even if cases of 14 or more days' duration are excluded (table 4). Moreover, 16 of the 22 cases reported to have lasted 2 weeks or longer are in Negroes.

That these figures on duration of illness are more or less typical of the disease in southwest Georgia is indicated by data on sore eyes collected in 1949 and 1950 during case history studies of diarrhea. In this study, several workers making house visits in the same general area conducted interviews at monthly intervals in 10 different communities in Thomas, Brooks, and Colquitt Counties (*4*). As in the 1951 data, the average duration of all recovered cases of sore eyes was shorter in white persons than in Negroes: 9.6 and 11.0 days, respectively. The average duration of those recovered cases which lasted less than 14 days was also shorter in whites than in Negroes: 5.0 and 6.1 days, respectively. The significance of this racial difference in reported duration of the shorter cases has a probability of less than 0.01 by the *t* test for unpaired data. The essence of the difference in both sets of data seems to lie in the much larger number of white cases said to have lasted 1 or 2 days (table 5). The basis of the difference between races need not be physiological; it may be sociologic, for example: (*a*) the degree of illness which each group accepts as a case of sore eyes, (*b*) the medical treatment given to cases by the two groups, (*c*) personal hygiene, or (*d*) some aspect of reporting, such as a tendency of white mothers to minimize the length of time their children remain ill.

Table 3. Numbers of persons having indicated number of cases of conjunctivitis per individual, by age and race

Age (years)	Number of cases									
	1		2		3		4		5	
	W	N	W	N	W	N	W	N	W	N
Total	32	36	13	4	4	0	0	1	1	0
Less than 1	3	4	---	---	---	---	---	---	---	---
1	5	6	1	1	---	---	---	1	---	---
2	1	6	2	---	1	---	---	---	1	---
3	2	4	4	1	1	---	---	---	---	---
4	3	1	2	---	2	---	---	---	---	---
5	2	2	1	2	---	---	---	---	---	---
6	3	1	2	---	---	---	---	---	---	---
7	3	---	---	---	---	---	---	---	---	---
8	2	1	---	---	---	---	---	---	---	---
9	1	1	1	---	---	---	---	---	---	---
10–14	2	3	---	---	---	---	---	---	---	---
Over 14	5	7	---	---	---	---	---	---	---	---

NOTE: W—White; N—Negro.

Table 4. Average duration of cases of conjunctivitis by race, May 17–October 29, 1951 [1]

Type of case	White		Negro	
	Number of cases	Average duration (days)	Number of cases	Average duration (days)
All recovered cases	33	2.6	13	4.9
All active cases	37	4.5	23	18.1
Recovered cases of less than 14 days' duration	32	2.3	12	4.1
Active cases of less than 14 days' duration	32	2.1	8	6.4

[1] Excluded are 7 cases which may or may not have been recovered on day of last pertinent interview and 11 cases for which total duration was not recorded.

Some light is shed on the question of reported duration of conjunctivitis by analyzing the records of treatment which were obtained in 1951. There are relatively more cases in the Negro population reported as having received no treatment (10 out of 48 cases) than in the white population (7 out of 74 cases). A greater difference, however, lies in the number of cases whose treatment included an antibiotic or the care of a physician (3 out of 48 in the Negro group, 30 out of 74 in the white group). Regardless of the efficacy of any medicine used, the Negro population appears to have secured less treatment of an up-to-date nature.

Table 5. Duration of recovered cases of conjunctivitis in southwest Georgia, by race, 1949–50 and May 17–October 29, 1951

Duration (days)	Number of cases			
	1949–50		1951 [1]	
	White	Negro	White	Negro
1	30	3	11	1
2	92	35	12	1
3	121	69	5	4
4	66	43	0	1
5	36	19	1	0
6	22	16	0	3
7	185	162	3	2
8–14	145	180	1	0
15–21	46	61	0	0
22–31	34	22	0	0
32–120	26	21	0	0
Total	803	631	33	12

[1] For cases for which approximate duration was given, whole days of duration were obtained by taking the first whole number above the mean.

Seasonal Occurrence

Grouped by month of onset, the cases of conjunctivitis in the white population show a small peak in June but are much more frequent in August, September, and October (table 6). The Negro cases have two peaks, one in June and one in October. The monthly attack rates present the same picture, but here, as in the monthly totals, the numbers of cases are too small to justify any interferences.

Table 6. Month of onset of conjunctivitis cases, by race, May 17–October 29, 1951

Month	White	Negro
May	3	7
June	10	12
July	8	5
August	18	6
September	15	7
October	21	11
Total	75	48

Spread Within the Family

In spite of strong circumstantial evidence that the eye gnat is a vector of sore eyes, there is no reason to question the importance of transmission of conjunctivitis by contact, especially within the family. Opportunities for the direct transfer of infectious material from one person to another can be assumed to be more frequent between members of a family than between persons in the community as a whole, and, on the basis of this assumption, large families might be expected to have higher attack rates than small ones. For comparison with the number of observed cases of conjunctivitis in families with different numbers of children, the expected number of cases can be computed for children 0–14 years of age (table 7) by adding the number of expected cases for each child in each family. The number of expected cases for each child is the product of the person-periods of experience for each child times the age-specific

attack rate, which is based on all children of the same age and race. By thus controlling the effect of age, the effect of family size can be evaluated separately. In the white families with 1, 2, or 3 children, the observed cases are somewhat fewer than those calculated from the rate for all families, and the ratio is reversed in families with more than 3 children. In the Negro families, the relative proportions of observed to expected cases are in just the opposite sequence, there being more cases in the smaller families than the data for the whole Negro group would lead one to expect. Statistically, there is no indication that the occurrence of sore eyes differs in families according to their size.

Another approach to the problem of intrafamilial spread of conjunctivitis is to study the relative rate of transmission within family groups by computing secondary attack rates. For diseases in which one case confers lasting immunity, the denominator of a secondary attack rate is simply the total number of family members less the number of primary cases. Because a case of sore eyes may not confer immunity for even a single season (note the large number of multiple cases in table 3), the denominator must be corrected to include only the persons actually at risk. The situation is similar to that studied by Badger and associates in an investigation of respiratory illness in Cleveland, Ohio (*5*, *6*). This group calculated secondary attack rates by studying selected units of family experience called episodes. An episode is defined as a period of 10 days which

Table 8. Number of episodes of conjunctivitis in southwest Georgia, grouped by numbers of index and secondary cases, May 17–October 29, 1951

Number of index cases	Number of secondary cases				Total episodes
	0	1	2	3	
1	63	6	1	2	72
2	4	1	0	0	5
3	2	0	0	0	2
4	2	0	0	0	2
Total episodes	71	7	1	2	81

(*a*) follows a period of 10 days without reported illness of the type under study, (*b*) starts with the day of onset of the index case (or cases), and (*c*) continues for 9 more days. Index cases are defined as all cases with onset on the first day of an episode.

In applying these definitions to the data on sore eyes, 12 cases were excluded, 3 because they were recurrences of another case in the same episode. Of the remaining 111 cases, only 15 were secondary, and of the 96 index cases, 63 occurred with no other cases in the same episode (table 8). The small number of secondary cases precludes obtaining satisfactroy secondary attack rates but does suggest that there is little spread within the family, at least after the first day of an episode. The fact that many families which had not had any previous or recent cases reported multiple cases with the same date of onset might

Table 7. Distribution of cases of conjunctivitis in southwest Georgia,[1] by number of children in family, May 17–October 29, 1951

Number of children 0–14 years old	White [2]			Negro [3]		
	Number of families	Number of cases		Number of families	Number of cases	
		Observed	Expected		Observed	Expected
1	17	8	12.96	5	3	1.60
2	9	13	14.61	5	5	4.93
3	5	16	18.75	11	18	15.47
Over 3	5	33	23.69	9	16	19.98

[1] Based on families with children under 15 years of age.
[2] The value of chi-square is 6.1 (d. f. 3, $P>0.1$).
[3] The value of chi-square is 2.4 (d. f. 3, $P>0.4$).

be the result of failure to recognize an initial case, but this is not necessarily so. Sore eyes will incubate in less than 24 hours, at least under artificial conditions (*7*); therefore, the spread from an original infection might be rapid enough to result in apparently simultaneous cases. Another possible explanation of the numerous cases occurring on the first day of an episode is that they might all be contracted from a source outside the family, perhaps even from eye gnats. If the infections are acquired through intrafamilial contact with an initial case, they are properly considered as secondary. If they are acquired, along with the initial case, from a source outside the family, they are indeed multiple index cases and their origin is a matter of real importance.

Diagnostic Symptoms

Whether or not a person was believed to have conjunctivitis, the record of the interview includes observations on all eye conditions of possible diagnostic value. These are reported as signs if observed during the physical examination, and as symptoms if included in the history. During the field work, bulbar hyperemia and purulent exudate were used to diagnose cases of sore eyes, and in consequence, these conditions may have been reported more completely than the rest. In other respects as well, the information on signs and symptoms must be interpreted with caution. One reason is that "sore eyes" is so common a disease in southwest Georgia that many informants would take little notice of the exact signs or symptoms in a particular case. Another reason for careful handling of the data is that many cases were very mild. Though provision was made to grade both signs and symptoms in three degrees of intensity—mild, moderate, or severe—"moderate" was used only five times in the records, and "severe" not at all.

Despite the character of the data, it is possible to compare some of the signs and symptoms in persons reported as having conjunctivitis with those in persons not reported as ill (table 9). This comparison shows that two eye conditions, palpebral hyperemia and palpebral crusts, are not reliable in the diagnosis of conjunctivitis. Palpebral hyperemia was found as a sign 50 times in persons believed to have, or to have had, sore eyes and 78 times in persons believed not to have the disease. Palpebral crusts were seen 31 times in persons counted as having or having had sore eyes, and 41 times in persons counted as negative. No other sign, except colds and nasal conditions, was noted more times outside the group affected by sore

Table 9. Frequency of signs and symptoms of conjunctivitis in southwest Georgia, May 17–October 29, 1951

Sign or symptom	Current cases 0–4 days old [1]		All current and recovered cases [2]		Persons not having conjunctivitis [3]	
	Times physically observed	Times reported in histories	Times physically observed	Times reported in histories	Times physically observed	Times reported in histories
Bulbar hyperemia	20	22	36	61	0	0
Purulent exudate	10	13	15	43	1	0
Palpebral hyperemia	12	3	50	7	78	1
Palpebral crusts	13	5	31	10	41	1
Nasal symptoms; cold	4	9	12	23	13	11
Increased lacrimation	1	4	1	9	0	0
Adherent lids	9	26	1	66	0	1
Photophobia	1	12	1	20	0	0
Palpebral edema	1	3	3	10	0	0

[1] 33 interview-examinations.
[2] 117 interview-examinations.
[3] 2,036 interview-examinations of persons without reported conjunctivitis in 2-week period preceding interview.

NOTE: This table is based entirely on interviews which included physical examination of the eyes. It does not include 122 interview-examinations in which the type of hyperemia was not specified.

eyes than within this group. Palpebral hyperemia and crusts are therefore of dubious use in diagnosis. As a matter of fact, palpebral hyperemia was often difficult to recognize with assurance, and the presence of crusts may be in part related (inversely) to the availability of a water source and the frequency of washing the face.

The use of histories in the diagnosis of sore eyes seems to be justified on the basis of one very characteristic symptom, adherent lids, usually observable only when the individual awakes in the morning and therefore rarely seen by a person doing interviews. This symptom is mentioned in the history of 2 out of every 3 current cases; it is the symptom most frequently reported; it is recorded as a symptom more often than any sign; and finally, it is cited only once in the entire study in a person without reported sore eyes.

Discussion

To consider conservatively the results and possible implications of the present investigation, it is well to review its limitations. In line with the original purpose of investigating possible contacts between persons who had acquired cases of conjunctivitis, the study population was concentrated in one small area. It therefore cannot be considered a satisfactory sample of any larger group, and its comparatively small size is another disadvantage.

The lack of bacteriological culturing, which might seem an insuperable handicap, was unfortunate, but it did not seriously affect the study of illness as distinguished from infection. Actually, illness due to conjunctivitis cannot be measured by routine bacteriological culturing because infection with one or another species of *Haemophilus* (*aegyptius* or *influenzae*) has been found to persist in essentially asymptomatic persons for several months, according to unpublished observations of Dr. Dorland J. Davis.

Another limitation is a deficiency in the information on duration of illness, which resulted from failure to obtain the date of recovery for some cases. Another difficulty is the lack of basic data on immunity and the resulting problem of calculating satisfactory case attack rates. Because the denominators cannot be corrected to exclude persons who were not at risk, the ratios do not represent an expression of the probability of infection and, accordingly, cannot be compared by means of the usual tests of significance.

In spite of all these drawbacks, several aspects of conjunctivitis observed in this study may well be characteristic of the disease over a much larger area. These findings are all concerned with differences between the white and Negro groups but are not dependent on the fact that the attack rates in the white group are higher than in the Negro group. First, the reported duration of acute cases is much shorter in the white group, and chronic cases (lasting 2 weeks or more) are much more common among the Negroes. Second, the records show that the white population took a more modern and more aggressive attitude toward the treatment of conjunctivitis. Third, in the white population there are more instances of multiple cases occurring in one individual. Fourth, the white age-specific attack rates decline more slowly with increase in age than do the Negro's.

These findings show that any attempt to measure the incidence of conjunctival disease should take into account the racial distribution of the population as well as its composition by age. They also indicate that much work needs to be done on the problem of susceptibility. Future studies of *Haemophilus* conjunctivitis should deal with the immunity conferred by previous cases, both treated and untreated, and should also explore the relation of overt illness to infection. With information on these aspects of the disease, it might be possible to show that, in areas where there are frequent opportunities for infection, the occurrence of new cases is closely related to losses in immunity.

Summary

An epidemiological study of conjunctivitis conducted in a rural town in southwest Georgia was based on interviewing and eye examinations without bacteriological culturing. Cases of conjunctivitis were less frequent and of longer duration in the Negro population than in the white population. There was no distinct

difference in incidence with respect to sex, but the incidence by age group was highest in children 1–4 years of age, decreasing rapidly in the age groups 5–9 and 10–14 years. This decline, which was more rapid in the Negro group, is discussed in addition to other racial differences. A study of intrafamilial spread showed that multiple index cases are very frequent and secondary cases relatively scarce. Palpebral hyperemia and palpebral crusts were of little or no use in visual diagnosis, but adherent lids, reported as a symptom by informants, were strongly indicative of conjunctivitis.

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Departmental Announcements

John Alanson Perkins, Ph.D., was sworn in as Under Secretary of Health, Education, and Welfare on April 5, 1957, to succeed Dr. Herold C. Hunt. Dr. Perkins has been president of the University of Delaware since 1950.

He was president of the American Society of Public Administration in 1953 and since that date has been a member of the Executive Board of the United Nations Educational, Scientific, and Cultural Organization. He has also served as a member of the Social Science Research Council's Committee on Organization for Research. He served as secretary to the late Senator Arthur H. Vandenberg and has been a teacher of political science both at his alma mater, the University of Michigan, and at the University of Rochester.

Dr. Perkins became budget director of the State of Michigan in 1946 and in 1948 was appointed controller of the department of administration. He has served as a member of the State planning commission and of the Educational Policies Commission of Michigan.

Edward Foss Wilson, a Princeton graduate, was sworn in as Assistant Secretary of Health, Education, and Welfare (Federal-State relations) April 5. Former president and chairman of the board of Wilson & Co., Inc., Chicago, he has been active in civic affairs and in various voluntary organizations.

Mr. Wilson has been director of the Presbyterian-St. Luke's Hospital for the past 20 years and of the Illinois Division of the American Cancer Society for the past 9 years. He is a member of the Council on Medicine and Biology of the University of Chicago.

For his many services in the field of health and welfare, a citizen fellowship was conferred upon him by the Fellows of the Institute of Medicine in Chicago on December 4, 1956.

Katherine Brownell Oettinger has been appointed chief of the Children's Bureau to succeed Dr. Martha M. Eliot, who recently resigned to become professor of public health at the Harvard School of Public Health.

Prior to her previous post as dean of the Boston University School of Social Work, which she assumed in 1954, Dean Oettinger was a division chief in the bureau of mental health, Pennsylvania Department of Welfare. Before that she was engaged in psychiatric social work at a children's treatment center in Scranton, Pa., and in child guidance and family welfare work in New York City.

Dean Oettinger has been on the board of directors of the Massachusetts Association for Mental Health and on the Advisory Committees of the Child Guidance Foundation and the Massachusetts Society for Crippled Children. She is currently a member of a number of organizations concerned with social work.

STATEMENT
by the Food and Nutrition Board,
National Academy of Sciences-
National Research Council

Cancer and Food Additives

IN the development of our knowledge of nutrition, primary emphasis has been given to deficiencies that may occur in our diets and to ways of safeguarding against them. Along with the application of such knowledge a notable reduction in dietary deficiency diseases has occurred. With decreasing need in the United States for emphasis in this direction, more effort has been devoted to the investigation of positive factors in foodstuffs that might be detrimental to health.

A group of conditions broadly termed "degenerative diseases" has assumed major importance as causes of illness and death in recent decades. The causes of these conditions are under intensive investigation, and especial emphasis is being placed on the role of environmental factors.

Causal relationships between environmental factors and human disease have long interested scientists. Indeed, knowledge of such relationships underlies most advances in preventive medicine. It is not surprising, therefore, that investigators at present are trying to determine whether factors in the environment are causally related to the occurrence of cancer in man. As has been true in the study of all diseases whose causes are unknown, the elements of the environment to which man is constantly or repeatedly exposed, for example, the atmosphere, water, and foodstuffs, command the greatest share of attention.

Legitimate Conjecture

Conjecture concerning possible cause and effect relationships is a common and sometimes an effective device in the development of new knowledge concerning disease. Many discussions concerning the possible relation of chemicals which may occur in foods to the occurrence of cancer in man have been held at scientific meetings, and reports of these have recently appeared in scientific publications. Scientists involved in discussions of food additives and cancer recognize the conjectures as such, and ascribe importance to them only insofar as they may stimulate the kind of inquiries which will help advance knowledge. When the scientific discussions, either written or spoken, have been reported through the press and other news media for public information, however, the conjectural nature of the scientists' discussions has frequently been forgotten, misconstrued, or poorly stated. This has contributed to the present apprehension among consumers over the safety of the food supply, and to the concern among food manufacturers over the possible loss of consumer confidence.

In view of these circumstances, it is desirable that a statement be made clarifying for the public the present state of knowledge about the relation between food additives and occurrence of cancer in man.

Known Facts

What is known concerning a definite relationship between ingestion of a substance and the subsequent development of cancer in man? Accidental repeated ingestion of radium paint or the use of so-called radium water has been followed by the development of cancer of the bone. The ingestion of certain aromatic amines, such as b-naphthylamine or 4-aminodiphenyl, through industrial exposure has been associated with the occurrence of cancer of the bladder. Epidemiological evidence indicates that a prolonged intake of sufficient arsenic may result in development of cancer of the skin.

Do these materials occur in the food supply of the United States? Arsenic is the only one. It may occur in some foods in extremely small concentrations as a pesticide residue and is normally present in certain foodstuffs which have received no pesticide treatment. Insofar as is known, there is no danger from the amount of arsenic likely to be consumed from these sources under ordinary conditions.

If this were all of the story, probably no public apprehension would have arisen.

Experimental Animal vs. Human Cancer

Investigators studying cancer have induced the development of tumors in experimental animals by purposely exposing them to a number and variety of chemicals. Such experimental cancer may be produced in animals by giving the agent by injection, by skin application, or orally. From this evidence and knowledge of how man may be like or different from the experimental animal in the metabolism, excretion, or storage of a particular chemical, the scientist can form a hypothesis as to how man might react to the ingestion of the chemical. In this respect, the conservative position would demand that substances that produce cancer in experimental animals should be excluded from human foods as a precautionary measure, even though it is known that a substance carcinogenic in one species is not necessarily carcinogenic in others.

Knowledge about possible cancer-causing agents in foods is, in general, at the point that studies are being devised and undertaken to test such possible relationships. This research is, by its very nature, expensive and time consuming. Years of study will be required to build definitive knowledge concerning all causes of cancer. There is a need to continue and expand present efforts to identify any relationships which may exist between environmental factors and the occurrence of cancer in man. Measures taken to safeguard the food supply can be only as effective as our state of knowledge permits. Government agencies, the food industry, and bodies such as the National Research Council are working together to facilitate the development of this knowledge and its effective application as soon as the information becomes available.

Pearl McIver Retires From PHS

Pearl McIver, R.N., B.S., M.A., will retire from the Public Health Service in June 1957 to become the executive director of the American Journal of Nursing Company. At present she is chief of Public Health Nursing Services, Division of General Health Services.

A pioneer and recognized leader in her field, Miss McIver was the first public health nurse to enter the Public Health Service. After serving 10 years as director of public health nursing with the Missouri State Board of Health, she was appointed in 1933 as a public health nursing analyst in the Division of Scientific Research. In 1935 she became chief of the Service's Division of Public Health Nursing, a position she held for 22 years.

A special consultant to the World Health Organization for technical discussions on nursing at the 1956 World Health Assembly, Miss McIver was named during the same year "Public Health Nurse of the Year" by the American Nurses Association. She was one of the recipients of the Lasker Group Award of 1955, and in 1951 received the Outstanding Achievement Award of the University of Minnesota.

Among the posts Miss McIver has held in a number of organizations were those of vice president of the American Public Health Association, president of the American Nurses Association, and chairman of the International Council of Nurses Committee on Constitution and Bylaws.

On Miss McIver's retirement, Margaret G. Arnstein, R.N., M.P.H., chief of the Division of Nursing Resources, will become chief of Public Health Nursing Services. Scheduled to assume the duties of Miss Arnstein is Apollonia O. Adams, M.A., now deputy chief of nursing resources.

Ethiopian Assignment

IN August 1954 the Ethiopian-American Public Health Joint Fund assumed responsibility for operating the Haile Selassie I Hospital in Gondar, Ethiopia. The fund's mission was the transformation of this institution of some 100 beds into a demonstration hospital and medical center where technical personnel would be trained. My main responsibility was to set up the laboratory. Primarily, it was to be used for training laboratory technicians, but it would also be available for use as a hospital service. My assignment also included teaching all the biological sciences and laboratory methods in the Public Health College and Training Center in Gondar.

I arrived in Gondar with my family on June 4, after 2 months at headquarters in Addis Ababa. Gondar is a town with a population of about 22,000 in northwestern Ethiopia. The great and pardonable curiosity of its populace was entirely reciprocated by my family. Because of our official status, a detail of rifle-carrying police was assigned to guard our house day and night, but at our request it was withdrawn.

Before the formal transfer of the hospital to the fund, we visited the grounds to become familiar with conditions and personnel.

Laboratory personnel consisted of 1 technician and 1 apprentice on detail for training from the nearby provincial army post. The laboratory equipment was a microscope, a table, some stains, and miscellaneous broken pieces of glassware. There was no laboratory budget; infrequent doles of alcohol were wheedled from the pharmacy, and Giemsa stain was purchased from time to time from personal funds of clinical staff members. Conferences with the laboratory technician, through an interpreter, revealed that he was performing a surprising range of simple laboratory procedures with practically no equipment, and that he was discouraged.

This technician, Ato Araya Guhley, had been presumably well trained at the Pasteur Institute in Addis Ababa, but owing to lack of working facilities his knowledge had deteriorated during the 8 years spent at the Gondar Hospital. He was at this time performing, more or less creditably, fecal examinations, blood counts, examinations for malarial parasites and relapsing fever, a simple urinalysis, and stains for tuberculosis, gonorrhea, and leprosy. He appeared to be sincerely interested in laboratory analysis and was enthusiastic about relearning things he had forgotten and in acquiring new skills.

Therefore, the first project was to stimulate Ato Araya with descriptions of projected development and to "sharpen" his performance. His response was satisfactory, and it was then possible to move on to a second phase of laboratory development.

Although the laboratory building was not completed, and the equipment not yet delivered, we decided to conduct a training experiment. A particularly alert youngster, a lad of 17 with 7 years schooling devoid of science instruction, was selected from a group of day laborers and put into the laboratory as a trainee. We wished to see if unusual pedagogical techniques were necessary.

The lad, Asfau Makonnen, turned out to be

Dr. Arthur H. Webb writes an account of his assignment in Ethiopia from April 9, 1954, to April 28, 1956. His duties involved setting up a laboratory in Gondar and teaching biological sciences and laboratory methods in a college in that town. During his tour of duty Dr. Webb was on leave from the post of assistant professor of bacteriology at the Howard University Medical School, Washington, D. C., to which he returned after completion of his assignment.

an unusually fortunate selection. After a mere 20 months in the laboratory, he carried most inventory details in his head, prepared solutions and reagents, performed all the technical operations, and helped train new personnel. He organized projects and prepared data for reports; it was only necessary to explain carefully what was wanted, answer a few questions, and then leave it to Asfau. This was a prime example of an individual who needed only a chance. There is no reason to assume that he is remarkably different from other bright boys; he merely points up the unexplored and undeveloped potential of his fellows. Rapport was facilitated not only by his high degree of innate ability, but also by his unusual proficiency in the English language.

Real laboratory work began in December 1954 with delivery of the laboratory supplies and equipment. These were packed in 34 boxes on two huge trucks which came approximately 400 miles over rough, wornout mountain roads from the port of Massawa, Eritrea, to Gondar, at an altitude of 6,700 feet. The road rises to 12,000 feet at points. The crew assembled to unload the boxes had had apparently little experience with packages of that size and weight. They were willing workers, but the fact that one box exceeded one man's strength was something new; this is an area where the standard load is a donkey load or head load. With much confusion, shouting, and effort, boxes started to move. The scene remains vivid: 500-pound boxes of glassware dropped 6 feet from truck bed to hard-packed earth . . . 12 men maneuvering a 600-pound case to place it carefully on the back of one man . . . watching that one man literally sink into the earth beneath his load . . . trying to live through the conference that ensued before the box was finally lifted off the man . . . wondering whether lives would be lost . . . then, unpacking . . . the gay and vigorous hacking with axes and sledge-hammers at cases that contained precision instruments . . . one man inside a large box pitching out small packages.

Miraculously, out of approximately a quarter million separate pieces not a single item broke. Inventorying was smooth but slow because the new laboratory trainees, previously selected and called to duty at this time, were unfamiliar with most items.

Two weeks after delivery of the equipment, training proceeded in earnest. Ato Araya, the senior technician, continued to be responsible for hospital work, while Asfau, the first trainee, assisted with new men. The first project was urinalysis; this was done on a somewhat mechanical basis without reference to theory. After about a month of this, when hands and eyes became familiar with colors and manipulations, the student health officers attending the Public Health College and Training Center entered laboratory training. Through the lectures for college students, the laboratory trainees learned the significance and theory of the manipulations they had already learned mechanically. Then too, with their new mechanical skills, they were able to give individual instruction to the professional students. Laboratory trainees and health officer students took the same examinations. As expected, trainees did better in practical work, and students excelled in theory.

In a relatively short time it was possible to build up a staff with fair proficiency in hematology, examination of feces, urinalysis, detection of blood parasites commonly found here, simple microscopic bacteriology, and syphilis serology.

The selection of personnel, ordinarily a major program, was simplified by the large number of applicants. Men chosen sometimes "on hunch" have on the whole worked remarkably well. Alazar was developing proficiency as a bacteriologist; Mammo's Kahn test was to be depended upon; and Mellise would some day be a competent hematologist. Gebre Sellassie and Asfau worked well in all fields. There were as yet no specialists; all had to serve where the work was heaviest. But each was allowed a measure of responsibility in one field; for example, all Kahn testing had to be done under Mammo's supervision.

While technical divisions of the laboratory were developing, the service branches were working, also. Since the trainees who spoke English were schoolboys without dependents, we staffed the washroom with mature men with families. These three were beginning to speak

a little English and were enthusiastic and faithful. Alemu, an amputee who had been dependent on the hospital social service department, was able to marry and establish his own home. Tashoma was like a proud housewife in his zeal to keep the building clean. Beyenne had learned to make bacteriological culture media and was now training as a laboratory technician. But the washroom had not always been so harmonious. The men had had no experience with laboratory glassware, and breakage was exuberant. Gradually, it came to be no more than one would expect in an operation of this size.

In October 1954 the teaching program of the health center started. Twenty-four young men of a broad variety of educational backgrounds were received. Some were proficient in English; some barely understood it. The course in biology cum physiology that I taught 4 hours a week for 15 weeks was about the hardest work I have ever done. Not only did I teach biology, I taught English as well, defining every word and writing it on the board.

Next were two trimesters of formal instruction and laboratory practice in the usual clinical diagnostic procedures, with emphasis on simple techniques considered most useful and reliable under field conditions.

When the second school year opened in October 1955, a second class of 34 health officer students and a first class of 20 community nurse students were admitted. The staff had decided to give the students short basic survey courses in biology, mathematics, physics, chemistry, and other sciences so that all students could be presumed to have had certain standard basic information.

I conducted a basic biology course of 16 lectures and demonstrations, designed as a background for understanding the functioning of the living organism. At the same time, second-year health officer students were assigned to the laboratory on rotation and, working under supervision of laboratory personnel, helped perform the laboratory routine.

During the second trimester of this school year, this laboratory practice was continued, and courses in microbiology were given to first-year male students and to community nurses.

The laboratory teaching of relatively inexperienced students is a process calculated to turn hair gray. The burden of individual instruction was partially solved by drafting three laboratory workers into the teaching laboratory as "graduate assistants." Seeing that students followed directions demanded constant vigilance.

Despite these difficulties, as well as chronic shortages of materials and lack of sufficient microscopes, instruction was given in microscopic fecal examination for parasites, hematology, the Kahn test for syphilis, and microscopic bacteriology. The second-year health officers made some small start in clinical chemistry as well.

There had always been at the Gondar hospital an informal training program for Imperial Army personnel. The army post commander, who is highly popular with the international personnel readily agreed to establish a laboratory to utilize the experience of soldier trainees, and a laboratory was set up with supplies and materials "loaned" from our stock on a returnable "if" and "when" basis. This installation served an army community of about 3,000 persons, did 10 to 15 tests a day, and sent us material for those procedures which it could not carry out. We continued to supply the installation.

Early in 1956 we were approached by the director of medical training, Ethiopian Ministry of Public Health, who asked us to share a training program with the Pasteur Institute of Addis Ababa. The arrangement provided for 6 months of didactic instruction at Pasteur Institute and then for 6 months of practical training in our laboratories.

In 1956 the laboratory employed 10 persons and had 5 army and Pasteur Institute trainees. For the first 25 days of that month, we registered 953 people for whom we performed 980 tests.

A fairly trustworthy service in hematology was offered, and our urinalysis and fecal examinations were good. We did only the Kahn test for syphilis, but the serologist was enthusiastic and ready to learn other tests. His performance could be depended upon. Bacteriology and chemistry were slow in development, I suspect because they require more judgment

than the other procedures. Bacteriology was especially delayed because of the fluctuation in incubator temperature; nights were quite cool, and current was off entirely from about midnight to 9:30 a. m.

Therefore, although some of the projected services of the laboratory were not yet fully developed, some phases of the work were far enough along so that some crude figures could be analyzed. Some 4,000 stool examinations gave a positive figure of 74.4 percent. However, these were not general survey figures; they represent only persons who presented themselves for examination. Parasites found most often were *Ascaris* (30.2 percent), *Trichuris* (13.6 percent), and *Endamoeba histolytica* (34.8 percent).

A very low finding of 1.2 percent for ova of *Taenia saginata* is reported, although a high incidence of *Taenia* infection in humans was presumed. Beef is eaten raw on ceremonial and other occasions, and *Taenia saginata* is considered somewhat of a national pest. It is to be expected that beef animals are rather heavily infected. Indeed, purgation in the hospital sometimes produced a yard or two of tapeworm, but *Taenia* eggs were rarely found in stool examinations conducted by fairly competent people. There is, however, a universal practice of taking periodically a local vermifuge, Kosso, which must move out the mature egg-producing sections of the worm, leaving the upper portions intact. There is also the possibility, since gravid proglottids detach themselves and actively pass the anal sphincter to expel their ova on the outside, that the feces were not the place to look for them. If Kosso is actually effective against the large flat tapeworm, it must have practically no effect on the large round *Ascaris lumbricoides*, which showed up in almost every positive stool.

These laboratories were staffed entirely by Ethiopian nationals. One may feel competent to predict that perhaps after some are sent away for further training Bagemder Province will have a clinical and public health laboratory that will compare favorably with any similar institution in that part of the world.

Abstracts of Soviet Medical Literature

The National Institutes of Health of the Public Health Service has completed arrangements with the Excerpta Medica Foundation of New York City for the translation and publication of abstracts representing Soviet contributions to medical research. The plan calls for broad coverage of the Soviet medical sciences. The collected papers of the institutes located in various cities throughout the U.S.S.R. as well as the professional journal literature will be covered.

Soviet specialists will contribute abstracts to Excerpta Medica, Amsterdam. The abstracts will be edited by a permanent editorial committee of 30 Soviet scientists appointed by the Excerpta Medica Foundation in cooperation with the presidium of the Academy of Medical Sciences, U.S.S.R., and will be supplemented by verbatim translations of published abstracts of Soviet literature. The whole work will be under the editorial supervision of Excerpta Medica's own specialists. The resulting abstracts, published under the title of "Abstracts of Soviet Medicine," will appear throughout 1957 in two separate series: Part A, Basic Medical Sciences, and Part B, Clinical Medicine.

Venereal Disease Contacts of Servicemen in Massachusetts, 1949–55

By NICHOLAS J. FIUMARA, M.D., M.P.H.

IN PREVIOUS publications I have outlined the philosophy and principles which guide the civilian venereal disease control officer in his relations with the military venereal disease problem (*1–4*). Briefly summarized, the civilian control officer is aware of the fact that the control of venereal diseases among military personnel is a joint function of military and civilian authorities. A military program aimed at the prevention and control of venereal diseases will be effective only to the degree of joint participation by the military and civilian partners. Each group must assume responsibility in certain areas, but the work of one must complement the efforts of the other. Failure of one partner to carry out his assigned tasks or failure to integrate military and civilian responsibility will result in weakening not only of the military venereal disease control program but the civilian program as well. It is my purpose to describe our experiences over the past 7 years in locating and examining venereal disease contacts who were named by infected military personnel and who could be found in Massachusetts.

Contact investigation begins long before civilian authorities receive contact reports. Actually, contact investigation in the armed forces begins at the military installation with the infected serviceman who is being interviewed. It is the experience of venereal disease control officers that results of contact investigations vary, other factors being equal, with the adequacy or inadequacy of the interview (*5, 6*).

Once the interview is completed, the information obtained is transcribed on the prescribed epidemiological report form (PHS 1421–VD–REV. 3–53) and sent to the appropriate civilian health authorities. The essential contact information should be sent as speedily as possible. When feasible, telephone reports should be encouraged, and telegrams should be sent when out-of-state contact data are obtained. However, the prescribed report form must be completed and should be in the mail within 24 hours of the telephonic or telegraphic reports.

Who are the men in the armed services who contracted venereal disease during the last 7 years and named Massachusetts as "the place where their contact could most likely be found"? What is known about these men and their female sex partners? What were the results of our investigation? These data will be the subject of this report.

During 1949–55, 4,675 men in the armed services contracted venereal disease and named Massachusetts either as the place of encounter or exposure, or both. Of these men, 4,297 (91.9 percent) had gonorrhea, 269 (5.8 percent) had syphilis, and 109 (2.3 percent) had one of the minor venereal diseases. The number of infected military personnel reported in any one year fluctuated more or less according to the total strength of the armed forces during that year. Thus, with the increase in military

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personnel in 1951 and 1952 during the Korean conflict, reported military cases increased (fig. 1). As the total military strength began to decrease in 1953 and the ensuing years, reported cases of venereal disease decreased. Military cases constituted about 20 percent of the total reported venereal disease morbidity in Massachusetts.

Data on marital and racial status of military venereal disease patients have been kept only since 1951. About 62 percent of the military personnel were white; 38 percent were Negro. About two-thirds of the men were single; about 13 percent were married (table 1). These same proportions held roughly for both whites and Negroes. The widowed, divorced, and separated contributed slightly more than 2 percent of the series. The marital status of 19 percent of the military patients was not recorded. There was no significant change from year to year in the proportion of single, married, and widowed, divorced, and separated men or of their racial status (fig. 2).

The average age of the military personnel infected with venereal disease over these 7 years was 23.3 years and the average age of their contacts, 24.3 years (table 2). The mean age of both military patients and their contacts has not changed during the past 7 years in spite of the expansion of the armed forces.

However, when military patients are analyzed by ages from 18 to 29 years, inclusive, an interesting trend is observed. In general, the

Figure 1. Reported cases of venereal disease among military personnel, Massachusetts, 1949–55.

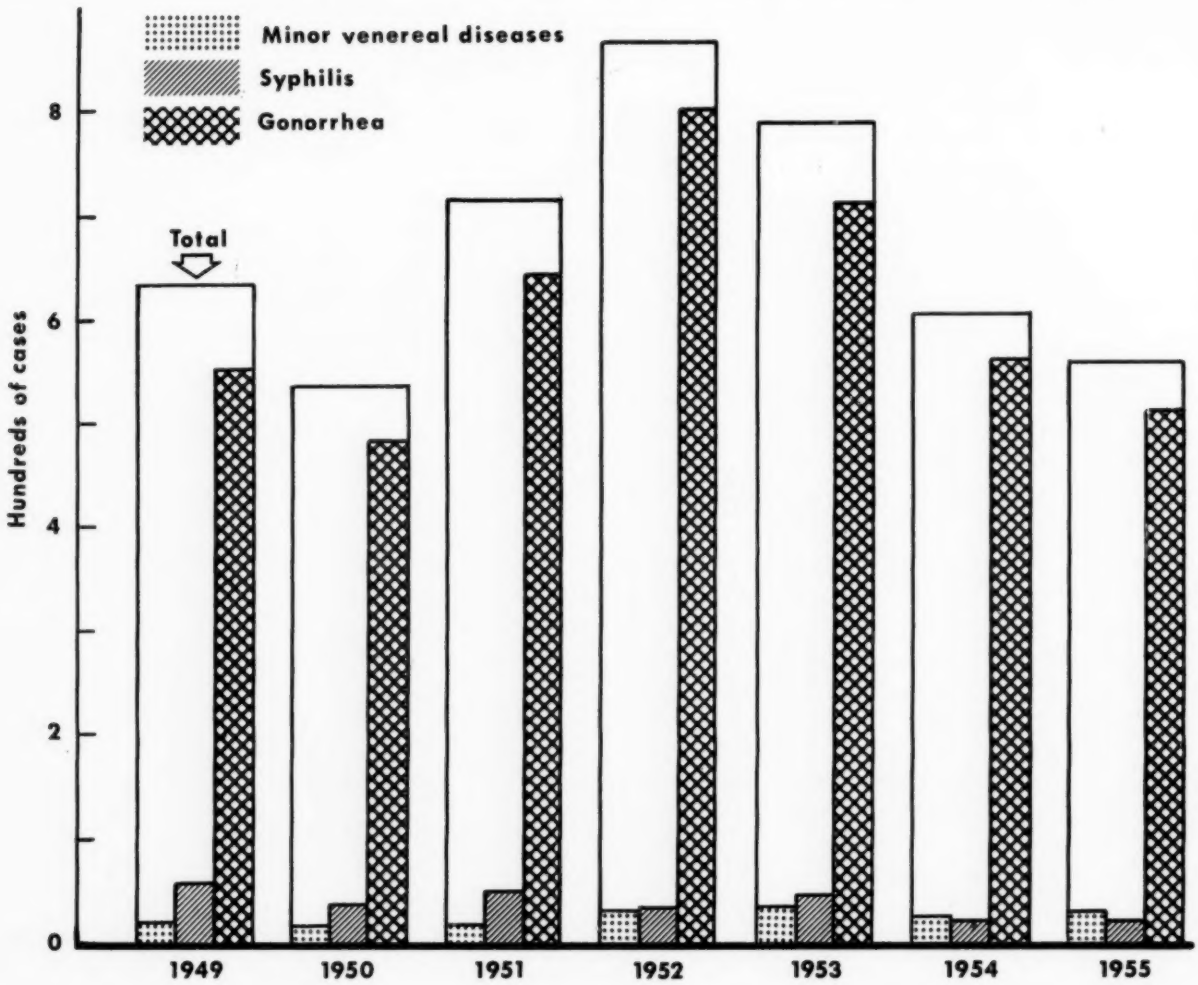


Figure 2. Race and marital status of military venereal disease patients, Massachusetts, 1951–55.

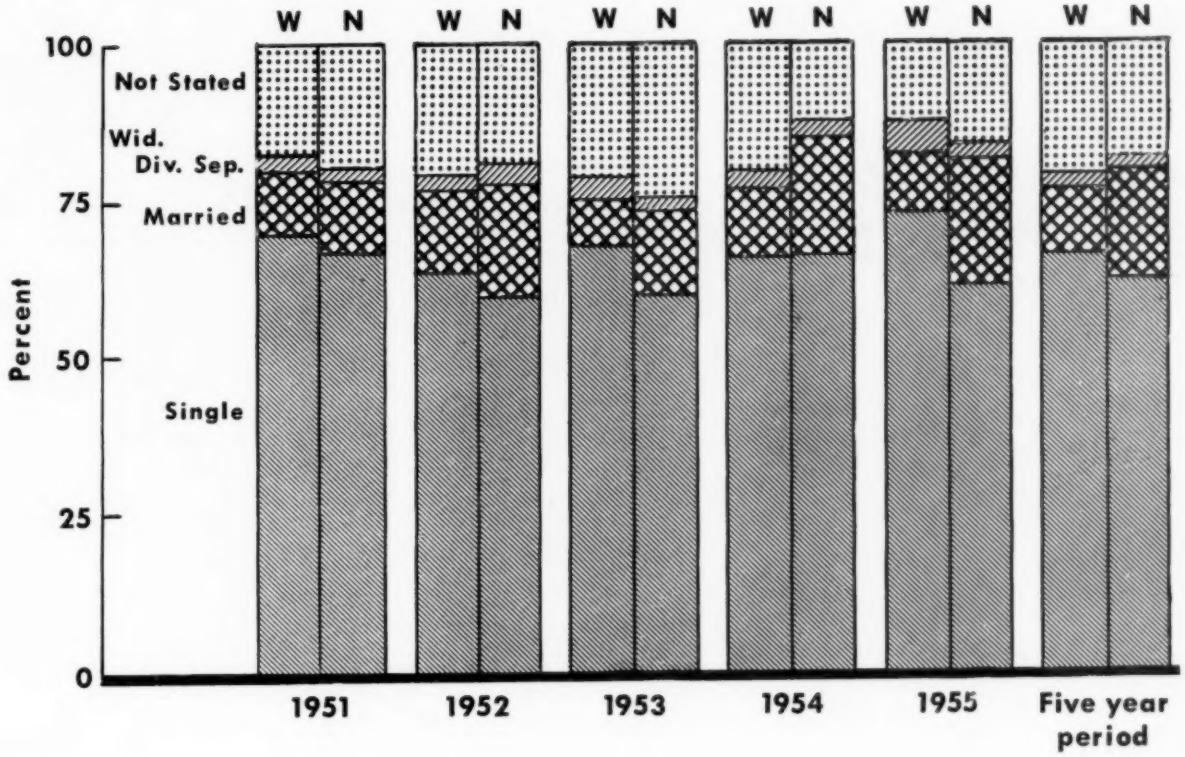


Table 1. Race and marital status of military venereal disease patients in Massachusetts, 1951–55

Year	Total	Single		Married		Widowed, divorced, separated		Not stated	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
	White								
1951	425	289	68.0	43	10.1	10	2.4	83	19.5
1952	564	352	62.4	74	13.1	14	2.5	124	22.0
1953	521	348	66.8	42	8.1	13	2.5	118	22.6
1954	358	237	66.2	37	10.3	9	2.5	75	21.0
1955	306	223	72.9	31	10.1	10	3.3	42	13.7
Total	2,174	1,449	66.7	227	10.4	56	2.6	442	20.3
	Negro								
1951	256	173	67.6	31	12.1	2	0.8	50	19.5
1952	303	183	60.4	57	18.8	9	3.0	54	17.8
1953	267	161	60.3	39	14.6	3	1.1	64	24.0
1954	245	162	66.1	48	19.6	6	2.4	29	11.9
1955	239	148	61.9	50	20.9	3	1.3	38	15.9
Total	1,310	827	63.1	225	17.2	23	1.8	235	17.9

military patients up to age 23 years dated older girls but at the age of 27 and older they dated younger girls. Thus, the serviceman in the age group 18–23 years named girls who were about one or more years older than himself. At ages 24–26 he would be apt to go out with girls of his own age, but when he reached the age of 27 years or older, he would most likely date girls one or more years younger than himself (fig. 3).

Table 2. Average age of military patients with venereal disease and of their contacts, Massachusetts, 1949–55

Year	Patients		Contacts	
	Age	Standard deviation	Age	Standard deviation
1949	23. 4	3. 9	24. 3	4. 7
1950	23. 3	4. 0	24. 7	5. 4
1951	23. 4	3. 4	24. 5	4. 5
1952	23. 6	4. 2	24. 1	5. 0
1953	22. 9	3. 8	23. 8	4. 4
1954	23. 0	2. 9	24. 7	5. 5
1955	23. 1	3. 8	24. 3	4. 7
Average	23. 3	3. 9	24. 3	5. 0

During the past 7 years 5,148 girls were named as contacts of the 4,675 infected servicemen, a patient-contact ratio of 1 to 1.1. What was the relationship of the female contacts to the military patients? Most of the girls (71.7 percent) were reported to be pickups, and 19.1 percent were said to be "friends." This word is quoted because in most instances the serviceman did not know his friend's name. Therefore, it is our opinion that about two-thirds or more of these so-called friends could be classified as pickups. Prostitutes were named in 6.4 percent of the total series, and homosexuals were reported in 14 instances (0.3 percent). Thus, as can be seen in table 3, our problem in Massachusetts, as in most areas of the country, centers about the pickup rather than about the professional prostitute. The same types of individuals were reported each year in approximately the same proportion.

How did the serviceman meet the girl? How were the female contacts found? About 96

Figure 3. Age of military venereal disease patients and of their contacts, Massachusetts, 1949–55.

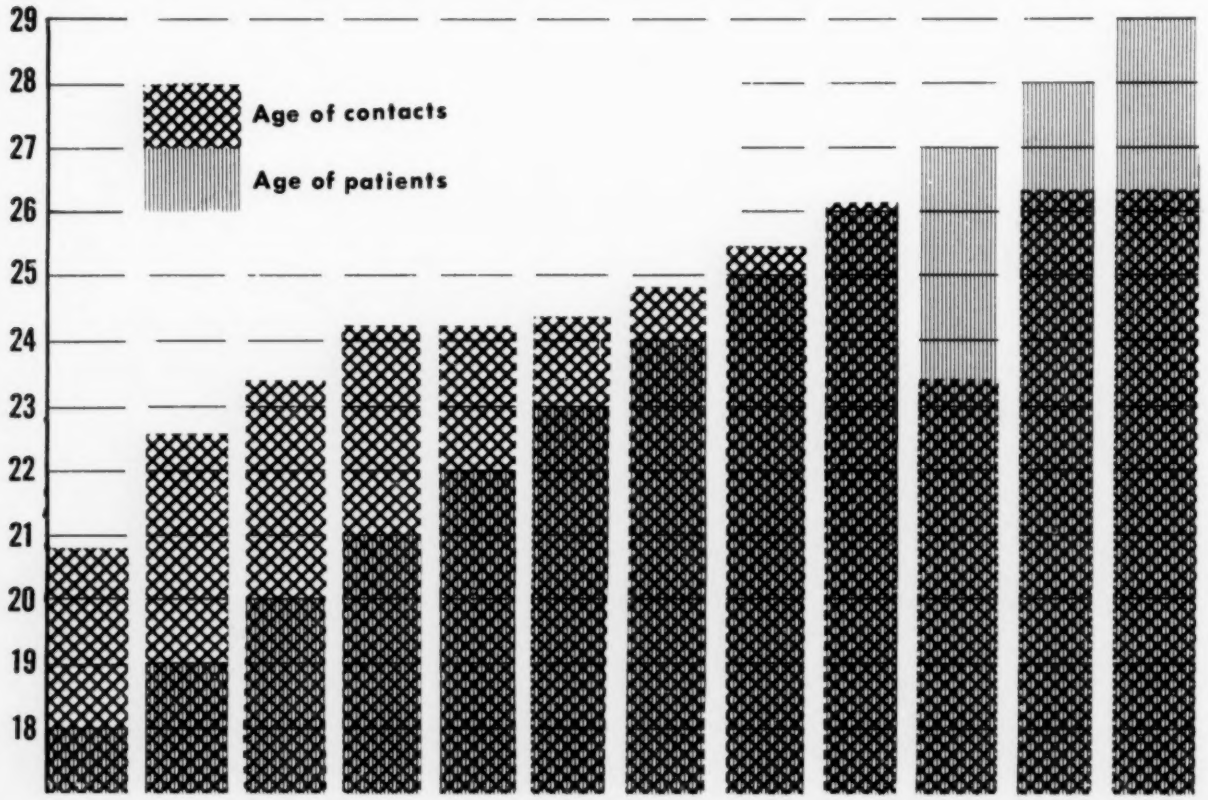


Table 3. Relationship of contacts to military venereal disease patients, Massachusetts, 1949–55

Year	Total contacts	Relationship to patient											
		Pickup		Friend		Prostitute		Marital partner		Homosexual		Not stated	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1949	677	515	76. 1	120	17. 8	28	4. 1	8	1. 2	1	0. 1	5	0. 7
1950	567	425	75. 0	109	19. 2	25	4. 4	6	1. 1	-----	-----	2	. 3
1951	781	551	70. 6	144	18. 4	60	7. 7	16	2. 0	1	. 1	9	1. 2
1952	967	667	69. 0	203	21. 0	61	6. 3	28	2. 9	8	. 8	-----	-----
1953	906	655	72. 3	168	18. 5	58	6. 4	24	2. 7	1	. 1	-----	-----
1954	665	457	68. 7	137	20. 6	52	7. 8	18	2. 7	1	. 2	-----	-----
1955	585	421	72. 0	100	17. 1	47	8. 0	15	2. 6	2	. 3	-----	-----
Total	5, 148	3, 691	71. 7	981	19. 1	331	6. 4	115	2. 2	14	. 3	16	. 3

percent of the military patients stated that contacts were found through their own efforts. Pandering was mentioned in less than 1 percent of the cases, thus indicating indirectly the absence of active, widespread commercialized prostitution (table 4).

Where did the encounter and exposure take place? About 63 percent of the female contacts were said to have been met in a bar. Next in order of frequency was the contact's home which was mentioned by about 12 percent of the servicemen interviewed (table 5). Slightly more than one-third of the exposures for military patients took place in a home, about one-fourth in a hotel, and about one-fifth in an automobile (table 6).

What type of contact information did the interviewer obtain and what were the results of the investigation of these contacts? Complete information was available on 26.8 percent of the 5,148 contacts of military patients sent to us for investigation. With complete information, 85.9 percent of the contacts were found and examined, whereas with incomplete information only 47.6 percent of the contacts were located. Contact information is considered to be complete if there is furnished the contact's complete name and address, her first and last name and telephone number, her first name and telephone number, her complete name and place of employment, or her complete name without the address if it is accompanied with the name

Table 4. Procurement of contacts of military venereal disease patients in Massachusetts, 1949–55

Year	Total contacts	Contact procured by—															
		Serviceman		Pimp		Taxi driver		Bellhop		Friend		Other		Not stated		Not applicable [1]	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1949	677	646	95. 4	3	0. 4	4	0. 6	5	0. 8	-----	-----	8	1. 2	3	0. 4	8	1. 2
1950	567	544	95. 9	4	. 7	1	. 2	2	. 3	-----	-----	10	1. 8	-----	-----	6	1. 1
1951	781	759	97. 2	-----	-----	1	. 1	5	. 6	3	0. 4	1	. 1	4	. 5	8	1. 1
1952	967	927	95. 9	1	. 1	6	. 6	-----	-----	7	. 7	3	. 3	-----	-----	23	2. 4
1953	906	876	96. 7	5	. 6	-----	-----	1	. 1	-----	-----	-----	-----	-----	-----	24	2. 6
1954	665	639	96. 1	7	1. 1	-----	-----	-----	-----	-----	-----	1	. 1	-----	-----	18	2. 7
1955	585	568	97. 1	1	. 2	-----	-----	-----	-----	-----	-----	1	. 2	-----	-----	15	2. 5
Total	5, 148	4, 959	96. 3	21	. 4	12	. 2	13	. 3	10	. 2	24	. 5	7	. 1	102	2. 0

[1] Wife named as contact.

Table 5. Place of encounter between contacts and military

Year	Total contacts	Contact encountered in—											
		Bar		Home		Street		Dancehall		Beach or park		Bus or railroad	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1949	677	450	66. 5	68	10. 1	53	7. 8	6	0. 9	15	2. 2	11	1. 6
1950	567	378	66. 7	49	8. 7	72	12. 7	11	1. 9	7	1. 2	7	1. 2
1951	781	466	59. 7	92	11. 8	56	7. 2	12	1. 5	16	2. 0	6	. 8
1952	967	624	64. 5	145	15. 0	47	4. 9	18	1. 9	15	1. 5	5	. 5
1953	906	590	65. 1	110	12. 2	81	8. 9	11	1. 2	18	2. 0	7	. 8
1954	665	404	60. 8	97	14. 6	84	12. 6	6	. 9	4	. 6	4	. 6
1955	585	347	59. 3	76	13. 0	57	9. 7	13	2. 2	11	1. 9	7	1. 2
Total	5, 148	3, 259	63. 3	637	12. 4	450	8. 7	77	1. 5	86	1. 7	47	. 9

[1] Wife named as contact.

Table 6. Place of exposure of military venereal disease patients, Massachusetts, 1949–55

Year	Total contacts	Place of exposure											
		Contact's home		Automobile		Hotel		Rooming house		Beach or park		Street	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1949	677	244	36. 0	65	9. 6	270	39. 9	10	1. 5	27	4. 0	9	1. 3
1950	567	190	33. 5	93	16. 4	200	35. 3	24	4. 2	21	3. 7	5	. 9
1951	781	267	34. 2	152	19. 5	209	26. 8	29	3. 7	18	2. 3	6	. 8
1952	967	363	37. 5	189	19. 6	259	26. 8	29	3. 0	19	2. 0	13	1. 3
1953	906	368	40. 6	189	20. 9	216	23. 8	38	4. 2	19	2. 1	9	1. 0
1954	665	313	47. 1	142	21. 3	123	18. 5	31	4. 7	6	. 9	3	. 5
1955	585	250	42. 7	153	26. 2	107	18. 3	19	3. 3	19	3. 3	2	. 3
Total	5, 148	1, 995	38. 8	983	19. 1	1, 384	26. 9	180	3. 5	129	2. 5	47	. 9

Year	Taxi		Tourist camp		Brothel		Other		Not stated		Not applicable	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1949	7	1. 0	9	1. 3	2	0. 3	12	1. 8	14	2. 1	8	1. 2
1950	3	. 5	4	. 7	4	. 7	5	. 9	12	2. 1	6	1. 1
1951	5	. 6	8	1. 0	------	------	5	. 6	72	9. 2	10	1. 3
1952	9	. 9	8	. 8	------	------	6	. 6	55	5. 7	17	1. 8
1953	7	. 8	7	. 8	1	. 1	2	. 2	28	3. 1	22	2. 4
1954	3	. 5	1	. 1	1	. 1	------	------	24	3. 6	18	2. 7
1955	2	. 3	------	------	------	------	------	------	18	3. 1	15	2. 5
Total	36	. 7	37	. 7	8	. 1	30	. 6	223	4. 3	96	1. 9

venereal disease patients, Massachusetts, 1946–55

Contact encountered in—												Year
Hotel		Brothel		Taxi		Other		Not stated		Not applicable [1]		
Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
34	5.0	2	0.3	----	----	19	2.8	11	1.6	8	1.2	1949
22	3.9	----	----	1	0.2	7	1.2	7	1.2	6	1.1	1950
24	3.1	3	.4	1	.1	19	2.4	73	9.3	13	1.7	1951
11	1.1	----	----	3	.3	18	1.9	55	5.7	26	2.7	1952
5	.6	----	----	----	----	19	2.1	42	4.6	23	2.5	1953
3	.4	3	.4	----	----	15	2.3	27	4.1	18	2.7	1954
3	.5	----	----	----	----	15	2.6	41	7.0	15	2.6	1955
102	2.0	8	.1	5	.1	112	2.2	256	5.0	109	2.1	Total

Table 7. Results of investigation of venereal disease contacts of military personnel located in Massachusetts, 1949–55

Year	Number contacts investigated	Examined									
		Total		Infected						Not infected	
				Total		New cases	Treated on suspicion	Under treatment	Previously treated		
		Number	Percent	Number	Percent	Number	Number	Number	Number	Number	Percent
1949	677	369	54.5	305	45.1	93	149	60	3	64	9.4
1950	567	303	53.4	265	46.7	76	130	59	----	38	6.7
1951	781	453	58.0	394	50.4	83	235	74	2	59	7.6
1952	967	608	62.9	530	54.8	164	291	72	3	78	8.1
1953	906	526	58.1	452	49.9	116	260	76	----	74	8.2
1954	665	392	58.9	338	50.8	112	178	3	45	54	8.1
1955	585	336	57.4	290	49.6	101	152	33	4	46	7.9
Total	5,148	2,987	58.0	2,574	50.0	745	1,395	377	57	413	8.0

Year	Not examined						
	Total		Uncooperative	Cannot locate	Insufficient information	No reply	Died
	Number	Percent	Number	Number	Number	Number	Number
1949	308	45.5	1	212	89	6	----
1950	264	46.6	1	192	67	4	----
1951	328	42.0	1	226	93	8	----
1952	359	37.1	1	281	67	9	1
1953	380	41.9	2	289	80	9	----
1954	273	41.1	2	210	58	3	----
1955	249	42.6	----	178	66	5	----
Total	2,161	42.0	8	1,588	520	44	1

and address of a friend or associate. Information is classified as complete or incomplete on receipt of the contact data at our central office. In many instances, on investigation it is found that the data furnished by the patient are erroneous or false. In spite of this, however, for statistical purposes the information is still coded as complete. Thus, the staff was able to find about 58 percent of the named contacts of military patients (table 7, fig. 4).

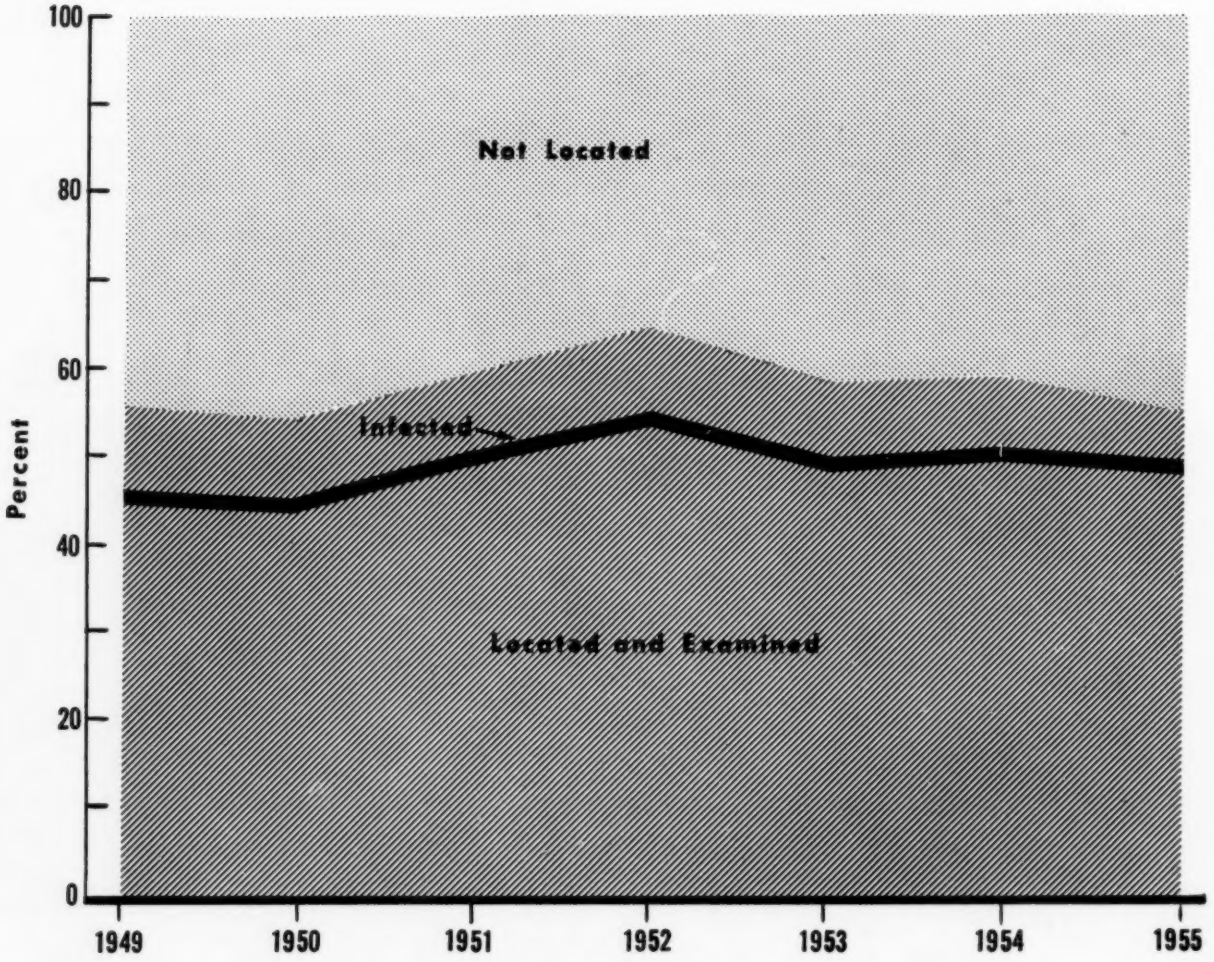
Summary

Between 1949 and 1955 there were 4,675 armed forces personnel who contracted venereal disease and named Massachusetts as the place of encounter or exposure, or both. About 92 percent of the cases reported were gonorrhea.

Approximately 62 percent of the military personnel were white and 38 percent were Negro. About two-thirds of the men were single, and 13 percent were married. These same proportions held roughly for both whites and Negroes. The widowed, divorced, and separated contributed slightly more than 2 percent of the series. In spite of an increase in the armed forces, the average age of the infected men and their contacts has not changed for the past 7 years. It was 23.3 years for the men and 24.3 years for the contacts.

The venereal disease control problem in Massachusetts centers about the pickup; the prostitute was named in only 6.4 percent of the

Figure 4. Results of investigation of contacts of military venereal disease patients, Massachusetts, 1949–55.



military cases. The bars are the focal point for most pickups. The home, hotel, and automobile, in that descending order of frequency, are the most common places of exposure.

The results of investigation of contacts depend to a great extent on the type of information supplied by the interviewer. When contact information was adequate, more than 85 percent of the contacts were found and examined, but with incomplete contact data, only about 48 percent were located. The overall result for the past 7 years was that 58 percent of the contacts reported were found and examined. This experience emphasizes the need for concentrating on better and more satisfactory contact interviewing and for devising more efficient methods of venereal disease control.

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John F. Mahoney, 1889–1957

Dr. John F. Mahoney, who developed penicillin as a cure for syphilis, died February 23, 1957. At the time of his death, Dr. Mahoney was director of the bureau of laboratories of the New York City Health Department; he was health commissioner of that city from 1949 to 1954.

Dr. Mahoney was a graduate of the Marquette University School of Medicine. He was commissioned as a medical officer in the Public Health Service in 1917, and in 1925, served as public health adviser to the U. S. Foreign Service. During this assignment in Haiti, Ireland, England, and Germany, he studied methods used in foreign clinics for the control of syphilis.

In 1929, he became director of the Venereal Disease Research Laboratory of the Public Health Service at Stapleton, N. Y., a position he held for 20 years. It was in this post that he discovered that syphilis could be cured with penicillin.

Dr. Mahoney won the Lasker Award of the American Public Health Association in 1946. The accompanying citation read in part: "The general use of your discovery during World War II helped bring about among our armed forces notable reductions in amount of time lost from duty because of venereal disease; in the same period there was no increase in syphilis among the American civilian population."

Dr. Mahoney served as chairman of the Committee of Experts on the Venereal Diseases, World Health Organization, and chairman of the Committee for Standardization of Serologic Tests for Syphilis, American Public Health Association.

The author of more than 50 papers and articles in medical, scientific, and professional journals, he served as associate professor in clinical syphilology at New York University School of Medicine, and in dermatology at Columbia University School of Medicine.

This second summary of the status of fluoridation includes the number of communities adding fluorides to their water supplies, the number of water supply systems, the population served, and the percentage of towns in each population category using this public health measure.

Status of Controlled Fluoridation in the United States, 1945–56

DURING 1956 fluoride was added for the first time to the drinking water of more than 6,500,000 people (table 1). This is nearly twice the number of people who started drinking fluoridated water in 1955. The 1956 increase was exceeded only in 1952 when 8,600,000 people started drinking fluoridated water.

In 1956, 213 communities started fluoridating their drinking water, a larger number than in each of the preceding 2 years. The number of water supply systems which these communities represent was slightly fewer than the number starting fluoridation in 1955 (92 compared with 96).

During the year, 12 water supply systems, representing 16 communities and serving a population of 185,000, discontinued fluoridation. Four water supply systems, representing an equal number of communities and serving 38,000 people, reinstituted the practice after discontinuance.

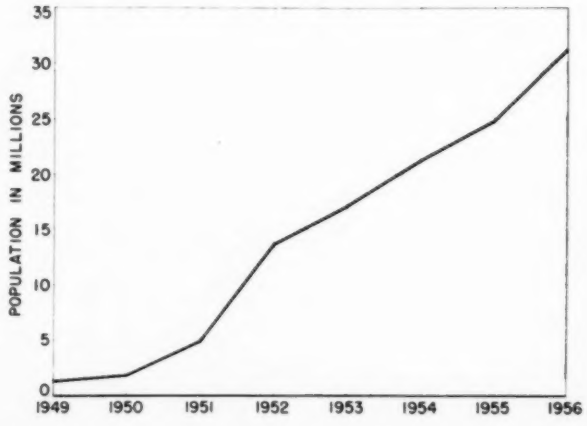
Although the annual rate of increase in the number of water supplies instituting fluoridation remained about the same during the last 3 years, there was a decline in the rate at which water supplies discontinued fluoridation. In 1954, 20 systems discontinued this public health measure. In 1956, 12 water systems stopped fluoridating. Two systems reinstituted fluoridation in 1954, four in 1956.

Prepared by the Division of Dental Public Health, Bureau of State Services, Public Health Service.

By the end of 1956 nearly 1,500 communities with 31,500,000 people fluoridated their water. It has been estimated that about 110,000,000 people in the United States are served by community water supply systems. At the present time about 1 in every 4 of these people are drinking water with adjusted fluoride content. It seems apparent that the number of people using water with a controlled fluoride content will continue to increase at a substantial rate.

The year 1956 was the 12th year in which the practice of adding fluoride to the drinking water in optimal amounts has been practiced as a caries control measure. The procedure was started in a few study communities in 1945. More study communities were added in 1946

Figure 1. Population drinking water with adjusted fluoride content, 1949–56.



and 1947. By 1949 and 1950 a small number of places, convinced of the benefits to be derived from fluoridation, instituted the measure as a regular practice. Late in 1950 published reports confirmed the anticipated reduced incidence of dental decay resulting from the addition of fluoride to drinking water, and national professional organizations endorsed the procedure. As a result, 109 communities in 1951 and 182 in 1952 decided to bring this health measure to their people, and the trend in reduction of tooth decay by an observed two-thirds was well under way.

As adoption of the procedure gathered momentum, the number of people drinking fluoridated water increased from about 1.6 million in 1950 to 5 million in 1951, 13.6 million in 1952, 17 million in 1953, 21 million in 1954, 24.8 million in 1955, and finally reached 31.4 million last year (fig. 1).

During the entire 12-year period, 80 communities, which at one time served fluoridated water to 1,900,000 people, discontinued the procedure. Of these, 10 communities, serving 223,000 people, reinstated the practice (table 2).

According to the 1950 Census of Population,

Table 1. Annual cumulative findings on the institution, discontinuance, and reinstitution of controlled fluoridation showing number of communities, water supply systems, and population served,[1] 1945–56

Year	Fluoridation status at end of each year			Fluoridation instituted whether or not discontinued		
	Number of communities	Number of water supply systems	Population	Number of communities	Number of water supply systems	Population
1945	6	3	231, 920	6	3	231, 920
1946	12	8	332, 467	12	8	332, 467
1947	16	11	458, 748	16	11	458, 748
1948	24	13	581, 683	24	13	581, 683
1949	46	29	1, 062, 779	46	29	1, 062, 779
1950	95	62	1, 578, 578	96	63	1, 595, 128
1951	329	171	4, 948, 259	331	173	4, 977, 709
1952	709	353	13, 552, 501	716	360	13, 754, 623
1953	949	482	17, 080, 930	961	494	17, 168, 202
1954	1, 128	571	21, 208, 304	1, 160	601	22, 361, 517
1955	1, 274	667	24, 775, 698	1, 332	713	26, 308, 979
1956	1, 487	759	31, 416, 112	1, 557	813	33, 095, 570

Year	Fluoridation discontinued whether or not reinstituted			Fluoridation reinstituted after discontinuance		
	Number of communities	Number of water supply systems	Population	Number of communities	Number of water supply systems	Population
1945						
1946						
1947						
1948						
1949						
1950	1	1	16, 550			
1951	2	2	29, 450			
1952	7	7	202, 122			
1953	14	14	253, 738	2	2	166, 466
1954	36	34	1, 323, 613	4	4	170, 400
1955	64	52	1, 717, 653	6	6	184, 372
1956	80	64	1, 902, 199	10	10	222, 741

[1] Most recently available population figures were used regardless of the year that fluoridation was instituted.

Table 2. Annual incremental findings on the institution, discontinuance, and reinstitution of controlled fluoridation showing number of communities, water supply systems, and population served, 1945–56

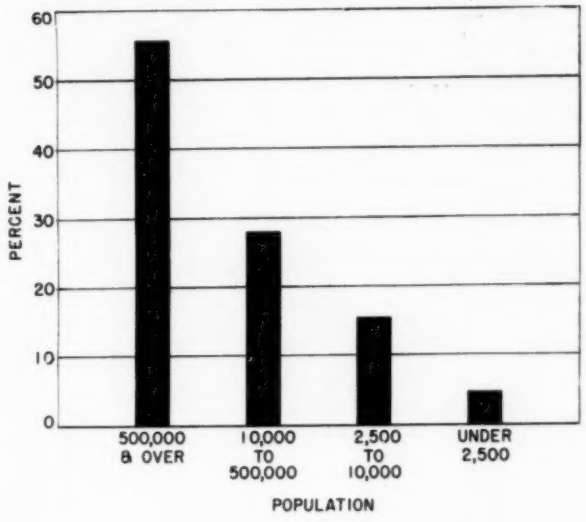
Year	Fluoridation instituted each year			Fluoridation instituted whether or not discontinued		
	Number of communities	Number of water supply systems	Population	Number of communities	Number of water supply systems	Population
Total	1, 487	759	31, 416, 112	1, 557	813	33, 095, 570
1945	6	3	231, 920	6	3	231, 920
1946	6	5	100, 547	6	5	100, 547
1947	4	3	126, 281	4	3	126, 281
1948	8	2	122, 935	8	2	122, 935
1949	22	16	481, 096	22	16	481, 096
1950	49	33	515, 799	50	34	532, 349
1951	234	109	3, 369, 681	235	110	3, 382, 581
1952	380	182	8, 604, 242	385	187	8, 776, 914
1953	240	129	3, 528, 429	245	134	3, 413, 579
1954	179	89	4, 127, 374	199	107	5, 193, 315
1955	146	96	3, 567, 394	172	112	3, 947, 462
1956	213	92	6, 640, 414	225	100	6, 786, 591

Year	Fluoridation discontinued whether or not reinstituted			Fluoridation reinstituted after discontinuance		
	Number of communities	Number of water supply systems	Population	Number of communities	Number of water supply systems	Population
Total	80	64	1, 902, 199	10	10	222, 741
1945						
1946						
1947						
1948						
1949						
1950	1	1	16, 550			
1951	1	1	12, 900			
1952	5	5	172, 672			
1953	7	7	51, 616	2	2	166, 466
1954	22	20	1, 069, 875	2	2	3, 934
1955	28	18	394, 040	2	2	13, 972
1956	16	12	184, 546	4	4	38, 369

there were 18,548 communities in urban and rural territory in the United States. Table 3 presents a comparison of these communities, by size group, with the numbers of places using controlled fluoridation. Two of the five communities of over 1,000,000 population are now fluoridating their drinking water as are 8 of the 13 communities of 500,000 to 1,000,000 population. Thus, 55 percent of the largest cities in the country have adopted the measure. From 25 to 30 percent of places ranging in size from 10,000 to 500,000, and 15 percent of the places from 2,500 to 10,000 population are now fluoridating. Of the 14,000 places of less than 2,500 population, only 5 percent are adding fluoride. Figure 2 shows the number of communities, by size, that have adopted the fluoridation procedure.

During 1956 the proportion of cities of 500,000 population and more that were fluoridating increased from 45 to 55 percent. Those with a population of from 10,000 to 500,000 people increased from 24 to 28 percent. The number of places from 2,500 to 10,000 in population

Figure 2. Percentage of communities fluoridating their water supplies, by size, December 31, 1956.



using fluoridation increased from 12 to 15 percent, and the percentage of those under 2,500 increased from 4 to 5.

Water supplies in 85 percent of all communities fluoridating are operated under public ownership. The proportion is similar among large and small cities.

How the institution of fluoridation was authorized is a subject of considerable interest. In nearly 85 percent of the communities the governing body alone constituted the authority for the action. In 5 percent, the authority was referendum; and in 4 percent of communities fluoridating, the utilities commission made the decision. It is interesting to note that in 91

Table 3. Total communities in the United States, by size group, compared with the proportion of each using controlled fluoridation, December 31, 1956

Population of community	Number of communities in urban and rural territory [1]	Communities using controlled fluoridation	
		Number	Percent of all communities of same size
Total	18,548	1,487	8.0
1,000,000 and over	5	2	40.0
500,000–999,999	13	8	61.5
250,000–499,999	23	7	30.4
100,000–249,999	65	19	29.2
50,000–99,999	126	42	33.3
25,000–49,999	252	78	31.0
10,000–24,999	778	201	25.8
5,000–9,999	1,176	209	17.8
2,500–4,999	1,846	251	13.6
1,000–2,499	4,296	277	6.4
Under 1,000 and not specified	9,968	393	3.9

[1] SOURCE: Number of places in urban and rural territory, by size of place: 1950. Statistical abstract of the United States, Bureau of the Census, United States Department of Commerce, 1955, table 15, p. 23. Places under 2,500 in urban territory distributed in proportion to the distribution in rural territory.

Table 4. Ownership and authorization for fluoridation in places fluoridating, December 31, 1956, by size of community

Population size of community	Number of communities	Ownership			Authorization			
		Public	Private	Other and not specified	Governing body alone	Referendum	Utilities commission	Other and not specified
Total	1,487	1,272	190	25	1,252	77	56	102
1,000,000 and over	2	2	0	0	2	0	0	0
500,000–999,999	8	8	0	0	7	1	0	0
250,000–499,999	7	6	1	0	7	0	0	0
100,000–249,999	19	17	2	0	17	0	0	2
50,000–99,999	42	36	6	0	39	1	0	2
25,000–49,999	78	70	7	1	70	2	2	4
10,000–24,999	201	180	15	6	173	12	5	11
5,000–9,999	209	177	30	2	180	10	1	18
2,500–4,999	251	214	28	9	208	9	6	28
1,000–2,499	277	235	35	7	233	9	10	25
Under 1,000	190	148	42	0	168	9	4	9
Not specified	203	179	24	0	148	24	28	3

percent of places of 25,000 and over in population, the procedure was authorized by the governing body. The smaller places resorted to referendum or utilities commission action with a little greater frequency—the largest percentage (6 percent) being observed in communities ranging from 10,000 to 25,000 in size. Table 4 shows findings on ownership and authorization.

Today, only 8 of the 18 cities in the country with over 500,000 population are not fluoridating. It is anticipated that most of these eight cities will institute fluoridation within the next several years. After that occurs the rate of increase in the number of people drinking fluoridated water will depend largely upon the rate of adoption in cities of between 10,000 and 500,000. The lag in the smaller centers may also be overcome during the next several years because of the greatly reduced costs that are now possible, the present availability of simplified and accurate techniques for determining the fluoride content of water supplies, and the growing public acceptance of the measure throughout the country.

Employment After Forty

In a move to reduce enforced idleness, at the root of many difficulties besetting older people, New York State has raised to 38 the number of "older worker" counselors in the State Labor Department's employment service now serving in 15 cities.

These specialists were able in 1956 to find jobs for 4,100 of the 11,000 job seekers over 45 years old who had found their age an insuperable stumbling block in the hunt for work and accordingly had suffered loss of confidence. With the help of the counselors, they were accepted as teachers, purchasing agents, methods engineering consultants, organ makers, foremen, construction workers, bookkeepers, and for a wide variety of other positions.

Supplementing the work of these specialists, State employment offices in all localities emphasize placement of all older workers including those with special problems not related to age. A quarter of a million jobs, better than 1 out of every 4 filled by the employment service in 1956, went to persons over 45.

In part this indicates a generally tightening labor market, but it also reflects efforts to persuade employers to abandon arbitrary age restrictions. In two cities, Newburgh and White Plains, the employment service found itself with more employer orders for mature workers than it could fill, until local newspapers helped encourage applications from older men and women who had thought that they would never find work again.

The professional office of the employment service in New York City, reporting 40 "older worker" placements in the first month after intensive efforts began, is one of the many offices to note changing and cooperative employer attitudes. Surprise has been expressed by employers at the variety and level of skill in the older group. This office reports that there is a new emphasis on qualifications rather than age and adds that these older workers have been placed in their own fields at their own level, an encouraging improvement over the stopgap type of job that they have been forced to take until recently.

—AVERELL HARRIMAN, *Governor of New York, in a legislative message, February 12, 1957.*

STATEMENT

by the Food and Nutrition Board, National Academy of Sciences-National Research Council

Supplementation of Dietary Proteins With Amino Acids

During the past few years the commercial production of a number of amino acids has progressed to the point where the cost is low enough to permit considering them for food fortification. Methionine is being added on an increasing scale to a greater variety of animal feeds. This practice has been shown to improve the feed with a consequent economic gain to the farmer.

Although there are a few reports on the benefits resulting from the supplementation of infant formulas with lysine (*1*), there is some question about the interpretation of the observation (*2*). Apart from the preceding consideration, there is a considerable amount of work with animals which indicates that the addition of an amino acid to a poor diet may sometimes aggravate the protein deficiency. These disturbances may result not only in poorer growth but also in the development of abnormalities such as fatty livers (*3*, *4*).

The Food and Nutrition Board of the National Research Council at a recent meeting issued the following statement.

The possibility of correcting a dietary deficiency of an amino acid by supplementation with that acid is an attractive one. There are, however, several guiding principles which should be emphasized at this time.

Attention is called to the Statement of General Policy in Regard to the Addition of Specific Nutrients to Foods, issued by the Food and Nutrition Board in November 1953:

"With carefully defined limitations, the principle of the addition of specific nutrients to certain staple foods is endorsed for the purpose of maintaining good nutrition as well as for correcting deficiencies in the diets of the general population or of significant segments of the population. The requirements for endorsement of the addition of a particular nutrient to a particular food include (*a*) clear indications of probable advantage from increased intake of the nutrient, (*b*) assurance that the food item concerned would be an effective vehicle of distribution for the nutrient to be added, and (*c*) evidence that such addition would not be prejudicial to the achievement of a diet good in other respects."

Some 25 amino acids are needed for the formation of the various cellular proteins of the body and for other special metabolic functions. Most of these acids can be synthesized by the body, if dietary protein intake is adequate. There are, however, at least eight which must be supplied daily by the protein in the diet in proportions and amounts to meet the requirements of metabolism. Any dietary protein which is relatively deficient in one or more of these essential amino acids has a reduced nutri-

tive efficiency. Emphasis is placed, therefore, upon the development of an adequate pattern of essential amino acids in the diet as well as upon the maintenance of an adequate protein intake. Although reasonable estimates can be made of the amino acid mixture which appears "ideal," the limits through which the pattern may vary and still be considered adequate are as yet unknown. Similarly, the definition of the amounts of protein of varying amino acid composition which are required for good nutrition under different physiological states requires further study.

There is reason for believing that nutritive requirements in disease may differ considerably from those in health. An amino acid pattern that is optimum for health and normal growth may require modification in pathological states in which the metabolism of one or another amino acid may be adversely affected. The study of amino acid metabolism in disease and the determination of desirable amino acid patterns in pathological states seem to be matters of great importance which may reveal particular needs for supplementation with specific amino acids or for the reduction of the intake of particular amino acids in the diet.

The imbalance of essential amino acids found in some dietary proteins cannot always be corrected by adding a single amino acid, the imbalance being the result of a deviation in several of the essential amino acids from an "ideal pattern" needed by the body. Multiple supplementation is generally required. This type of supplementation is at present best achieved by mixed diets where one food protein supplements another. The benefits to be derived from amino acid supplementation are uncertain until our knowledge of the consequences of the amino acid imbalance is more complete. The Food and Nutrition Board recognizes the potential value of proper supplementation with amino acids and the desirability of intensive study of this problem.

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Education Projects for Retarded Children

Two cooperative research projects on the education of mentally retarded children were approved by the Office of Education, Department of Health, Education, and Welfare, in April 1957.

One of the projects, to be directed by Dr. Frances Mullen, assistant superintendent of schools of Chicago, will deal with the educational problems of mentally retarded children in special and regular classroom conditions. The Illinois State Department of Public Instruction and the city of Chicago will both participate.

The other project, with California participating, will be concerned with the effects of special training classes for severely retarded children. Dr. Leo Cain, dean of education services of San Francisco State College, will direct the project.

Sixty-six projects have been approved for cooperative educational research since September 1956. Thirty-nine of these concern education of the mentally retarded.

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